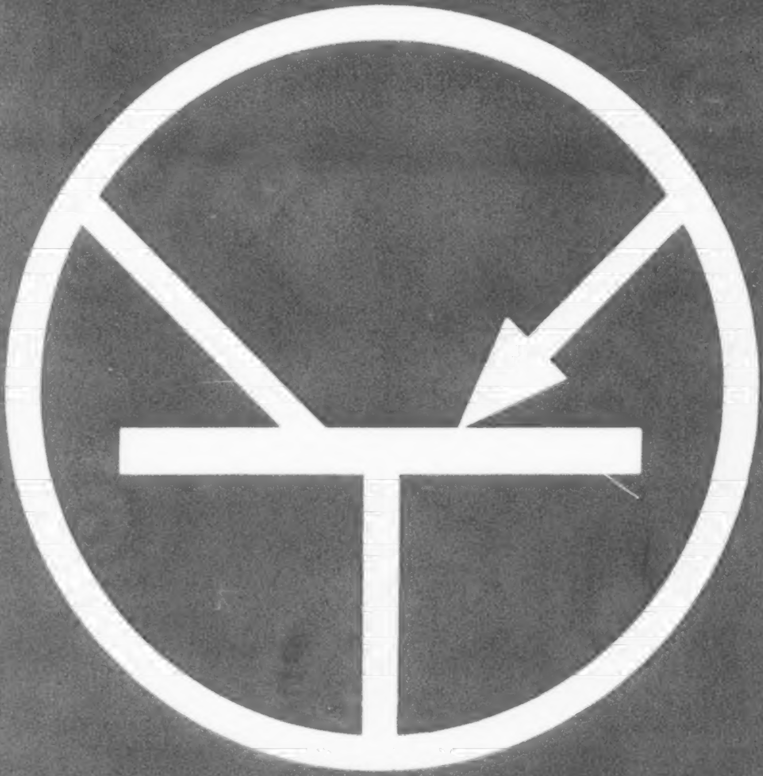
73

Amateur Radio

August 1964

50c



TRANSISTORIZED ISSUE

EVERYONE *S
using the
"CENTURY" DESIGN CONVERTERS
(AND INVERTERS) MANUFACTURED EXCLUSIVELY BY LINEAR SYSTEMS, INC.

* GE
* COLLINS
* SBE

CUSTOM DESIGN FOR ANY APPLICATION

the best supply money can buy

AVAILABLE THROUGH YOUR DEALER OR WRITE FOR FURTHER INFORMATION

LS LINEAR SYSTEMS INC.

The "CENTURY" is providing the ultimate in performance when powering these fine transceivers in mobile service.

605 UNIVERSITY AVENUE
LOS GATOS, CALIFORNIA

73
Magazine

Wayne Green W2NSD/1
Editor, etcetera

August, 1964

Vol. XXII, No. 1

73's Advertising Rates

	1-5 times	6-11 times*	12 times*
2 pages	$520	$488**	$456**
1 page	268	252**	236**
1/2 page	138	130	122
1/4 page	71	67	63
1/8 page	37	35	33
1/16 page	20	19	18

Add fractional page prices for sizes not listed.
⅜ p = ¼ p + ⅛ p.
*We must have a written contract for frequency discount.
**No extra charge for second color for full page ads on contract.
Second color (usually red, but our choice) . . .
$25 per page or fraction.
Half or full page bleeds are 10% extra.
No special positions can be promised for color pages.

73 Magazine is published monthly by 73, Inc., Peterborough, N. H. The phone number is 603-924-3873. Subscription rates $4.00 per year, $7.00 for two years, $10 for three years world wide. Second class postage is paid at Peterborough, New Hampshire and at additional mailing offices. Printed in the US.A. Entire contents copyright 1964 by 73, Inc. Postmaster: please send form 3579 to 73 Magazine, Peterborough New Hampshire.

Two Band Transistor Transmitter QZ7BQ 6
Two Meter Transistor Receiver K6TOV 14
Stripping Transistor Radios K8YCH 20
UHF Beacon W6GGV 22
Squelch for Transistor Receivers .... Geisler 28
Those Fragile Transistors K4CPR 29
Transistor AM-FM VFO WA0HQA 30
Transistor Final for Forty W0TKX 34
Minute KW Power Supply K8IKA 40
The Signal Helper W3WJN 44
Transistorized Receiver .... Morgan 46
Simplified Transistor Biasing W2HQY 54
Transistors for Ham Use WA4HWH 63
Vanguard Modifications K0VQY 64
Heath SB-300 .... WA2TDH 66
Time for a Change W7ZC 68
Moonbounce News W2NSD/1 72
Correspondence from the Members 74
Another Keyer K9SGZ 76
Design Hints: Transistors K0VQY 82
Beast for Ten WA2WYJ 84
Propagation .... Nelson 96

Letters 12, 61, 80
New Products 71, 80
Diode Tester 92
Gonset on CW 92

de W2NSD/1

never say die

It's too bad so few of you read CQ anymore. Their few articles may be dull, but you're missing hilarious editorials. In May and June they called me every nasty name they could think of and warned everyone that I was out to destroy the ARRL and take over ham radio. Beware.

The July editorial has a new boogey man. It seems they have discovered that a small group is trying to take over ham radio. They didn't explain what this means, but obviously it is bad news. CQ says that this group of schemers has been smearing ARRL on the air and via club bulletins. They have formed numerous societies and associations, have wormed their way into the amateur equipment industry, etc. Their purpose is to destroy the ARRL and "take over."

I mulled this over. My first reaction was one of pique. I expected to get another of their editorial treatments, and instead I've been relegated to the letter-to-the-editor trash dump. I'm last month's threat . . . I don't count anymore.

Then I started wondering what on earth they were talking about. I usually hear about everything going on in our hobby just before or just after it happens, but this one took some figuring. Perhaps CQ was referring to their own Clif Evans K6BX. Certainly he fit much of the description. He has been haranguing ARRL on the air at great length, has been publishing bulletins, and has been quoted in other club bulletins. Certainly there has been no more bitter critic of the ARRL than Clif. Unfortunately for the League just about everything that Clif has been saying has been unarguably true and ARRL has been able to do nothing but fume and hope that he would go away. But since the K6BX-column is still in CQ they must mean someone else.

Between Huntoon's "Dirty Letters" to all ARRL affiliated clubs and Cowan's editorials I thought that groups would be warned not to muscle in on my "take over" of amateur radio.

Plain rot. Does CQ identify this group or anyone in it? You bet they don't. Perhaps you've noticed that when I talk about someone I name names. Cowan, if there is a plot afoot anywhere but in your own imagination, let's have some names. I don't expect any names to be forthcoming for it seems more than likely to me that this about-face in editorial policy at CQ is linked to a desperate attempt to use controversy to arouse some interest in their magazine. I know that advertising has been dropping off badly for them, now reaching about the lowest point in almost ten years. Possibly circulation has done the same? This might explain their sudden move to what looks very much like an abandoned Howard Johnson restaurant out in the sticks (Styx?).

Yes, I read the letters in CQ. Isn't it nice to be so popular that other magazines are talking about you? Most of the writers are quite familiar . . . every field has some like that. The one that I fancied the most was from the Tiny Green Cucumber (WA2TGC). This kid turned up here a week before I took the 73 tour to Europe and was put on trial to see if he could back up his claims of being a top notch technician. Virginia said not to do it, that he was a dope. I gave him a list of things to be done by the time I got back from Europe.

A week after I returned I went up to the mountain and checked to see what the Cucumber had accomplished. I was dumbfounded. In six weeks he had set us back well over six months. I told him I would give him one more week to show some results. He said he guaranteed that he would have us on six meters by the end of the week. That's the last I've ever seen of him. He disappeared that night, complete with Al WA2WIQ. Al's father called a couple nights later and wanted to know where his boy was. I told him that Cuke and Al had scrammed, giving me no notice. He said that he was positive that Cuke had killed his son and that he was going to notify the police. Al, it seemed, had been telling his father about Cuke and there were things I didn't know about him . . . he was dangerous . . . how could I hire someone like that? First I'd heard. Apparently Al turned up alive for I've heard nothing further from his father.

Regarding the six meter antenna: as far as I know this was "appropriated" by K3LNM and is on his car. I'll buy Cuke a new one if

INTERNATIONAL FREQUENCY METERS

designed for servicing!

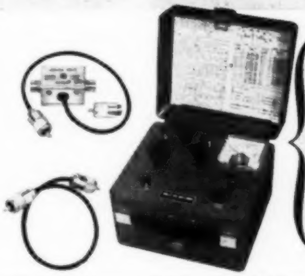
Equip your lab or service bench with the finest . . .

Discover new operating convenience.

FM-5000 FREQUENCY METER 25 MC to 470 MC

The FM-5000 is a beat frequency measuring device incorporating a transistor counter circuit, low RF output for receiver checking, transmitter keying circuit, audio oscillator, self contained batteries, plug-in oscillators with heating circuits covering frequencies from 100 kc to 60 mc. Stability: ± .00025% +85° to +95°F, ± .0005% +50° to +100°F, ± .001% +32° to +120°F. A separate oscillator (FO-2410) housing 24 crystals and a heater circuit is available. Dimensions: FM-5000, 10" x 8" x 7½".

FM-5000 with batteries, accessories and complete instruction manual, less oscillators, and crystals. Shipping weight: 18 lbs. Cat. No. 620-103 . . . . . $375.00
Plug-in oscillators with crystal $16.00 to $50.00



C-12B FREQUENCY METER For Citizens Band Servicing

This extremely portable secondary frequency standard is a self contained unit for servicing radio transmitters and receivers used in the 27 mc Citizens Band. The meter is capable of holding 24 crystals and comes with 23 crystals installed. The 23 crystals cover Channel 1 through 23. The frequency stability of the C-12B is ± .0025% 32° to 125°F, .0015% 50° to 100°F. Other features include a transistorized frequency counter circuit, AM percentage modulation checker and power output meter.

C-12B complete with PK (pick-off) box, dummy load and connecting cable, crystals and batteries. Shipping weight: 9 lbs. Cat. No. 620-101 . . . . $300.00

C-12 CRYSTAL CONTROLLED ALIGNMENT OSCILLATOR

The International C-12 alignment oscillator provides a standard for alignment of IF and RF circuits 200 kc to 60 mc. It makes the 12 most used frequencies instantly available through 12 crystal positions 200 kc to 15,000 kc. Special oscillators are available for use at the higher frequencies to 60 mc. Maximum output .6 volt. Power requirements: 115 vac.

C-12 complete, but less crystals. Shipping weight: 9 lbs. Cat. No. 620-100 . . $69.50

C-12M FREQUENCY METER For Marine Band Servicing

The International C-12M is a portable secondary standard for servicing radio transmitters and receivers used in the 2 mc to 15 mc range. The meter has sockets for 24 crystals. The frequency stability is ± .0025% 32° to 125°F, ± .0015% 50° to 100°F. The C-12M has a built-in transistorized frequency counter circuit, AM percentage modulation checker and modulation carrier and relative percentage field strength.

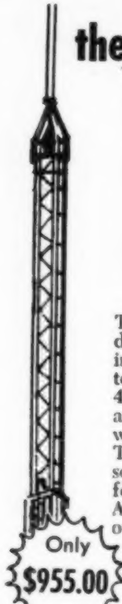
C-12M complete with PK (pick-off) box and connecting cable, batteries, but less crystals. Shipping weight: 9 lbs. Cat. No. 620-104 . . . . $235.00
Crystals for C-12M (specify frequency) $5.00 ea.

KEEPING YOU ON FREQUENCY IS OUR BUSINESS...

Write today for our FREE 1964 CATALOG

INTERNATIONAL
CRYSTAL MFG. CO., INC.

18 NORTH LEE OKLAHOMA CITY, OKLAHOMA



the LEADER in CRANK-UP TOWER DESIGN

The full-strength Hercules 66-3 has diagonal bracing—a unique feature in all E-Z Way Towers. It's designed to support a large 20 m or 40 m beam; 4 el. Du-band; or 6 el Triband Wind area 22 feet at 66 feet in 60 MPH winds.
The 3 sections of the Hercules telescope from a minimum height of 30 feet to a maximum 62 feet.
A worm gear winch tilts the tower over for easy access to your beam.

Only $955.00

MODEL TORBZ 66-3

WIND LOAD CHART

Model	Ant. Wind Area	Full Hgt.	Height MPH	Half Hgt.	Height MPH	Min. Hgt.	Height MPH
TORBZ 66-3	22.2	66	60	50	86	32	125
TORBZ 66-3	13.2	66	75	50	90	32	140
TORBZ 66-3	8.2	66	90	50	100	32	150
TORBZ 75-3	17.0	75	60	55	86	33	125
TORBZ 75-3	10.0	75	75	55	100	33	140
TORBZ 88-3	12	88	60	65	86	38	140

NEW E-Z WAY HERCULES
DELIVERS THE ULTIMATE IN TOWER POWER

HERCULES	Painted	Galvanized
TORBZ 66-3	955.00	1,095.00
TORBZ 75-3	1,055.00	1,240.00
TORBZ 88-3	1,187.50	1,393.50

100′ 115′ Heights available

MOTOR WINCH

The E-Z Way Motor Winch raises and lowers towers to any height without guys. When towers are motorized a larger beam can be used because the tower is normally lowered to safer elevations. Standard features: Combination worm gear drive; totally enclosed motor and gear box; remote control switch; spiral grooved winch drum; positive crank down and limiter switches. Assembled complete with hardware and instructions, just $389.50 for TORBZ 66-3; $399.50 for TORBZ 75-3 and $495.00 for TORBZ 88-3.

E-Z WAY TOWERS, INC.

5901 E. BROADWAY
TAMPA, FLORIDA

he'll bring our tool supply back to strength on the mountain.

Al, by the way, turned up with a friend of his after I'd left for Europe and wanted to work for 73. No one had authority to hire him while I was gone so he "helped" Cuke up on the mountain. Our Volkswagen station wagon was turned over coming down the mountain by the friend and he skipped out, leaving us with a few hundred dollars in repairs.

It is interesting to read about Cuke working for me . . . he talked with me for just a few minutes during his stay. He knew nothing about me . . . about 73 . . . or about anything else we are doing. His long suits seemed to be sleeping late, drinking coffee and mulling over what was to be done. He makes an excellent witness for CQ, I'd say.

If anyone is really interested in the rest of the crud CQ published they can send a stamped envelope and I'll enclose a complete rundown on the rest of the "Cukes" who wrote in. Ask for Cuke Letter.

Readers of the Autocall and Washington Amateur Radio News, a hate sheet put out specifically to tear the Institute of Amateur Radio apart, may ask for my WARN letter.

Lies?

It has not escaped me that the League has set out to "expose Wayne Green's lies," if I may quote their letter to all affiliated clubs. The letter is an emotional appeal, "misinformation . . . distortions . . . innuendo . . . unfounded rumors" . . . etc.

Please understand the basics before we go to specifics. The fundamental problem is that the Institute of Amateur Radio has been started and this is considered as a threat to the League. Headquarters is not unaware of the deep split that they've driven into the amateur ranks. They are not able to admit their mistake introducing RM-499 and they know that this dissention has simplified the growth of the Institute. Thus they are fighting back at the Institute by personally attacking me and passing off all criticism I may have of the League as lies, distortions, etc.

Now, putting the emotional hysteria aside, we find that the League claims to dispute my report of the Mexico City debacle. I reported that the meeting was held to form Region 2 of the IARU. I reported that the societies balked at this and formed their own organization, which ARRL was allowed to join. The League does not deny this, they avoid

(Turn to page 85)

IoAR News

Don't Take Amateur Radio for Granted

Harry Longerich—W2GQY/4

About the only difference between a rut and a grave are the dimensions! And believe me, we as amateurs have been in a well defined rut for some time. Unfortunately the American amateur, generally speaking, has done very little in taking the initiative to extricate himself from this pleasant rut. He's allowed the "other guy" to make his decisions for him. "Why bother about it; I paid my dues, so why worry?" Then the "other guy" decides he's going to fix this deplorable mess that has crept in among the U. S. amateur fraternity. Wow! The guy in the rut sits up like he's been hit with a bucket of water. He screams bloody murder for a few months and then lies down again, hoping that this will "go away" like the other things which came up in the past—but will it? The pattern is quite clear. Based upon past performance and results these actions "came to be" and we accepted them with some anguish and cries of foul. Are we as American amateurs prepared to continue to accept this pattern from here on in?

Most amateurs don't like to be criticized, even though the criticism is constructive and friendly. Why wait for "someone else" to pass judgment upon you and your hobby? Why not make a critical self appraisal right now and see what the weak points are? This is about the only way you can take the necessary steps to insure that ham radio will remain the wonderful hobby that it is. What can you do as an individual amateur? Plenty! First, find out who represents you in your area. Let him know how you feel and why. Second, start discussions in your local club and bring issues which affect you and your club out in the open. Develop a position which represents the majority feeling. Third, go on record with the appropriate amateur representative of your area so that he knows the "what," "where," "why" and "when" of your club's feelings in the matter. Fourth, take an active part in the over-all affairs which have a direct or indirect bearing upon amateur radio, and last, don't take amateur radio for granted. If you enjoy the many facets of this hobby of ours it's worth quite a bit of your effort and time to insure that you have a voice and say in matters concerning them. You certainly don't let anyone else decide for you in matters which concern your welfare and interests. Or *do* you?

Think about this for a while and if you're the type who doesn't care one iota about the future of amateur radio, then stop reading right here. Congratulations! The chances are that you are really interested in furthering and preserving amateur radio. Also, it's pretty certain that you are already a well informed individual and that you're willing to devote time and energy toward preserving and enhancing amateur radio. "Let's have at it," you say. Fine.

a. Let your voice or the voice of your club be heard through the Institute of Amateur Radio.
b. Become a Founding Member in your area.
c. Have a say in who is elected to represent your views.
d. Know how your money is spent—where, why and by whom.

Why the Institute of Amateur Radio?

- The IoAR represents *you*.
- The IoAR is local, national and international in scope.
- The IoAR represents *all* persons who are, or are interested interested in becoming amateurs and are dedicated to preserving and furthering the art of amateur radio.

Thinking about improving our hobby is good, but don't stop at that. The important thing RIGHT NOW is to take an active and personal part by becoming a Founding Member of the IoAR today. A booklet explaining the IoAR will be sent free upon request to:

L. P. Haslam
W3AYA
14208 Dav Road
Rockville, Maryland

THE
INSTITUTE
OF
AMATEUR
RADIO

The Institute of Amateur Radio was well represented at the Confederate States Hamfest in June. Left to right are Ed Schaad WA4PDX, Ed Saalis W4UQK, Lloyd Haslam W3AYA, and Harry Longerich W2GQQY/4.

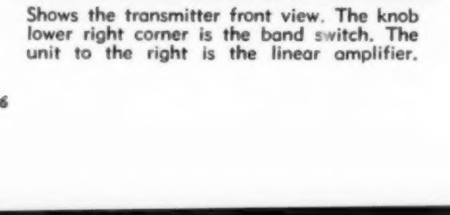
Hans Jorgen Rasmusen OZ7BQ
Borgevej 31
Kgs. Lyngby, Denmark

A Two Band Transistor Transmitter

The Transistor has now been developed to such a stage that relative high power can be delivered on the HF bands. It is therefore time to start using these new transistors in transmitter construction instead of tubes. The transmitter, to be described in this article, covers the eighty and twenty meters phone bands, and has an output of approximately one quarter watt. However this power level could easily be raised to 10 watts or more by using newer transistors.

Before going into details with the transmitter, it might be useful to recall that a transistor is not a tube, and consequently is not supposed to act as such. The greatest difference lies in the fact that transistors are power driven devices, whereas tubes are voltage driven devices; this, however is about the only difference one needs to remember when building and adjusting transistorized equipment.

Regarding the description of the transistorized 80 and 20 meter SSB transmitter, transistors offer many advantages over tubes when used in lower power SSB exciters. Heating is no longer a problem and the resulting troubles with frequency drift is eliminated. The power drain is much lower, which makes the rig much handier for portable use. The long-time stability of transistors seems to be very good, so a transistorized rig should not call for realignment as frequently as would be necessary in tube rigs. These are only a few of the reasons the author built a transistorized rig.

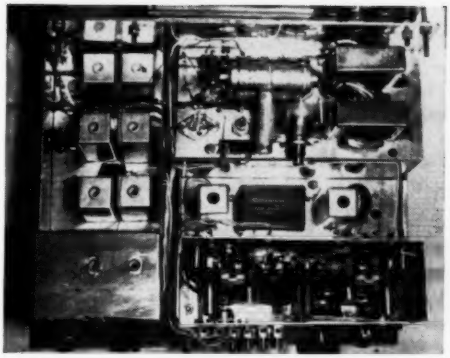


Shows the transmitter front view. The knob lower right corner is the band switch. The unit to the right is the linear amplifier.

The block-schematic in Fig. 1 shows the different parts of the transmitter. Carrier is generated on 9 mc, and is fed to a balanced modulator, to which the audio from a 3 stage audio amplifier is also feed. From the modulator the signal—a DSB signal—goes to a 9 mc McCoy crystal filter, where one of the sidebands is cut away. From the filter the signal (which is now a SSB signal) goes to an amplifier and further on to a mixer stage. Into this stage is also injected a signal from a 5 mc oscillator. At the output of the mixer either the sum or the difference signal might be selected (3.8 or 14 mc) and fed to a stage of amplification before going into the final amplifier with an output of approximately 250-300 mw. Although this is not much power, it is sufficient for local contacts, and more than enough to drive the author's linear amplifier well beyond the 300 watts power limit in this country. The rig has an outboard VOX unit identical to the one described by Roy E. Pafenberg in December 1960 issue of 73 Magazine.

The Audio Amplifier

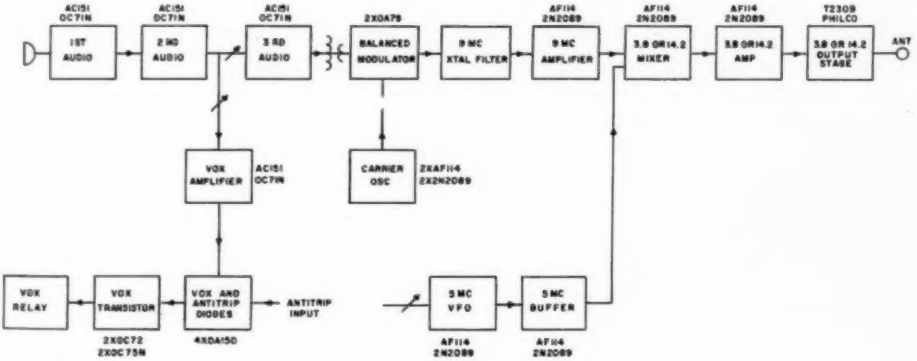
The audio amplifier consists of three transistors. The microphone to be used with this transmitter is a high-Z xtal mike, and since the input impedance of a common emitter stage is rather low, some sort of matching must be connected between the mike and the amplifier if there is to be no great loss in gain and quality. An input transformer might be used if it is already available, but a far better method would be to use a common collector stage as an impedance match. Such a stage has a very high input impedance, and an output impedance which will match quite well to the following common emitter stage. Between this stage and the output stage there is connected an audio gain control. In the collector circuit of the output transistor there is a driver transformer for a push-pull audio amplifier; only half of the output winding is used to feed the balanced modulator. All coupling- and by-pass capacitors in the audio amplifier have been made quite large, so that a good audio quality (that is, a reasonable amount of bass) can be obtained. The audio amplifier is not a critical part of the transmitter, so it is not necessary to bother with temperature stabilization. The ordinary dc-feedback method shown in schematic will work very well.


Shows the transmitter from above, to the left are the rf amplifiers, with the mixer near the front panel. To the right are first the power-supply mounted above the oscillator section. Instead of using a 48 volt ct transformer, two 24 volt transformers were connected in series. Next comes the filter section, and below the carrier and audio sections.

The Carrier Oscillator

The carrier is generated on 9 mc., and there is a separate oscillator for each sideband. There are several reasons for the use of two oscillators. The oscillator section had to be mounted in the rear part of the chassis, and it was therefore quite difficult to place a switch in such a manner that it could reach from the rear to the front panel and still leave enough room for other parts of the rig. Another, and probably better reason, is that it is quite difficult to get the crystals to oscillate on the proper frequencies because of the rather high input capacitance between base and emitter. It is therefore necessary not to add any more capacitance to the circuit than needed. The proper sideband is selected by switching the collector voltage to the oscillating transistor. Output is taken from the collector and fed to a broadband transformer wound on a ferrite toroid. The windings are bifilar, and there is no significant resonance in the transformer. Output is fed to the balanced modulator. The crystals are oscillating in a circuit similar to the tube circuit recommended by the McCoy factory, and it should be quite easy to get the oscillators on the proper frequencies by tuning the trimmers. Since these trimmers also control the feedback in the oscillators, it might very well happen that the oscillators have unequal outputs. This can be corrected by adjusting the resistors in the collector supply leads.

TRANSMITTER BLOCK DIAGRAM


AC151
OC71N
1ST
AUDIO
AC151
OC71N
2 ND
AUDIO
AC151
OC71N
3 RD
AUDIO
2XOA79
BALANCED
MODULATOR
9 MC
XTAL FILTER
AF114
2N2089
9 MC
AMPLIFIER
AF114
2N2089
3.8 OR 14.2
MIXER
AF114
2N2089
3.8 OR 14.2
AMP
T2309
PHILCO
3.8 OR 14.2
OUTPUT
STAGE
ANT
VOX
AMPLIFIER
AC151
OC71N
CARRIER
OSC
2XAF114
2X2N2089
VOX
RELAY
VOX
TRANSISTOR
2XOC72
2XOC75N
VOX AND
ANTITRIP
DIODES
4XOA150
ANTITRIP
INPUT
5 MC
VFO
AF114
2N2089
5 MC
BUFFER
AF114
2N2089

The Filter Section

The balanced modulator is of a very conventional design, using two shuntfed diodes. The coil is bifilar wound to assure a good balance. The carrier-nulling is done with a 1 kiloohm carbon potentiometer and a small variable capacitance. The transformer L_2 is a modified 10.7 mc miniature transformer. One of the sections is removed and a bifilar coil L_1 is wound close to the cold-end of L_2. The top of L_2 is coupled to the filter through a 5-30 mmfd capacitor. The filter is shunted by a resistor on 560 ohms to give a proper termination. The coupling network is an L-network, and it is very easy to adjust. The output terminal of the filter is also shunted by a resistor on 560 Ohms, and a tuned circuit with resonance around 9 mc, this resonance is not at all critical, because the coil is shunted with the 560 Ohms resistor. The two shunt resistors are probably not necessary at all, but they help make the tuning very easy. The filter is followed by an amplifier of conventional design, the collector circuit L_4 and L_5 is a standard 10.7 mc transistor *if* transformer. Most types on the marker will easily tune down on 9 mc, but if not they may be padded with an outside capacitor on 10-20 mmfd. There is no impedance match between L_4 and the transistor. It is not needed since the stage delivers gain, but does not add to the selectivity. Signal output to the rf-mixer is taken from the base link L_5 and fed through a piece of coaxial cable.

The Variable Oscillator

The variable 5 mc oscillator is probably the most critical part of the entire rig. If the frequency stability is poor, the exciter is of little value. Luckily, it is rather simple to make the VFO as stable as SSB operation calls for. One big advantage is of course that the transistor does not generate any heat. This almost eliminates all problems with warm-up drift. However, transistors have one fault which might make it difficult to build an oscillator with good long-time stability. This is the rising junction temperature, which is caused by the collector leakage current. The first step towards a stable transistor oscillator must therefore be to make a good DC stabilization. DC stabilization is also necessary because a changing collector current will cause a change in the transistor's load impedance and load capacitance. All capacitors must be of the best quality; as in a normal tube oscillator, silver mica capacitors and air trimmers must be used. Needless to say, all components must be rigidly mounted. The oscillator which tunes 5.1-5.35 mc, is followed by a buffer stage. With the coverage listed the exciter will tune 3.9-3.65 mc and 14.1-14.35 mc. The buffer stage is a must if good stability is to be obtained. This stage is a normal common emitter, and no trace of frequency shift was noted under modulation. The voltage for the oscillator and the buffer stage should be stabilized by a zener diode or powered from a separate battery, to eliminate pulling when the rig is used as a mobile exciter.

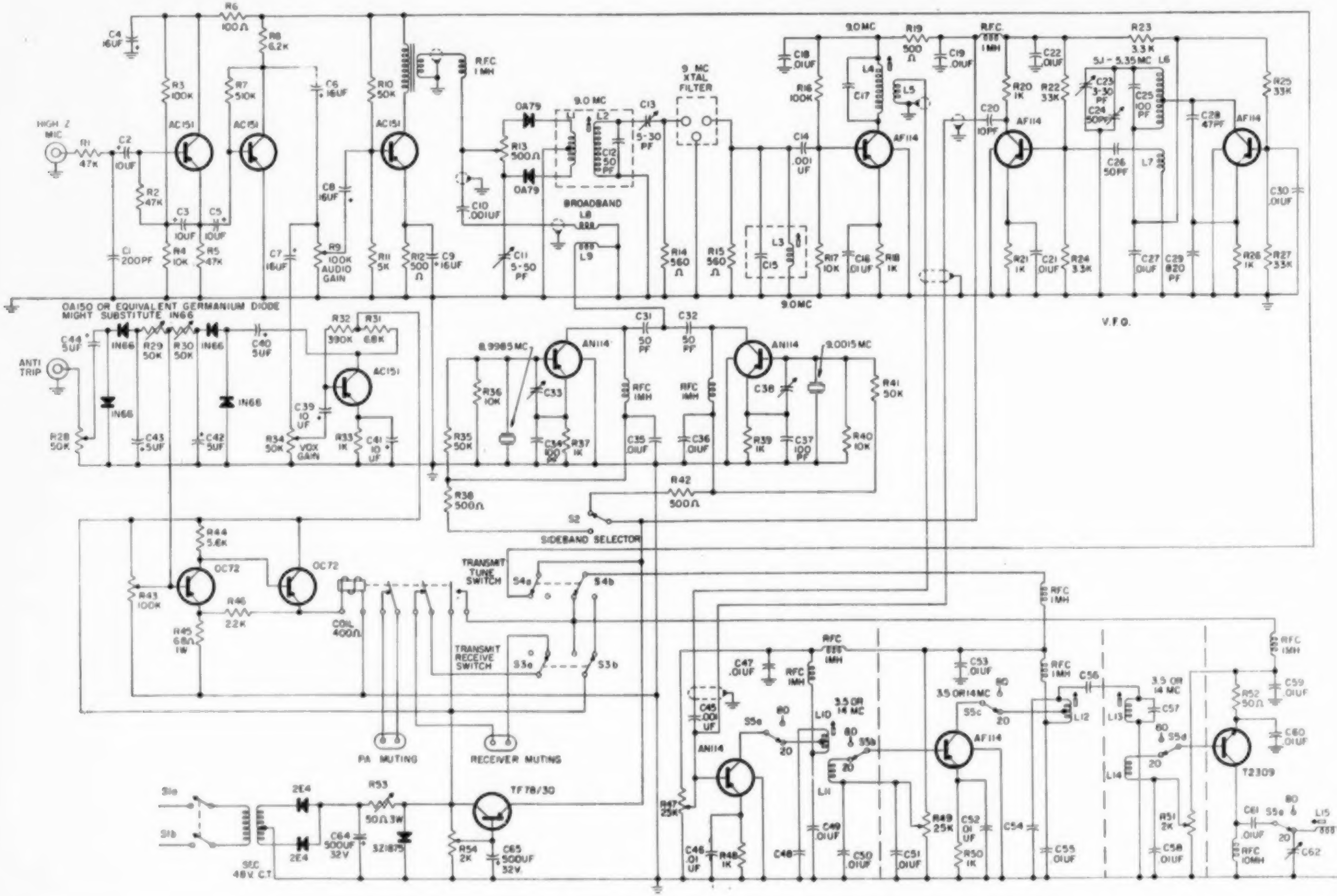
The RF Amplifiers

The rf mixer is a normal additive mixer stage. No attempt has been made to try a balanced mixer, since the mixer is followed by so many tuned circuits that there have been no troubles with any type of spurious radiation from the rig. The base circuit of the mixer should be well shielded, so that there is no possibility of rf pick-up from the linear amplifiers. Remember that the power level at this point is very low and not much rf is needed to make a feed-back chain. The proper base bias is selected with a small "set and forget" potentiometer. In the collector circuit there is a tuned circuit for 20 and 80 meters. The collector is tapped down on the coil L_{10} to give a good match, so that ample gain and selectivity can be obtained.

The mixer is followed by a common emitter rf amplifier stage. The rf signal is fed to the amplifier via a link L_{11} wound on the cold-end of L_{10}. One side of the link is bypassed to ground, both in the mixer and in the amplifier section. This is necessary to prevent self-oscillation and pick-up. The collector is tapped in on the collector coil L_{12} so as much gain as possible can be obtained. The coupling to the output stage is done through a band-pass filter. This band-pass filter is necessary to assure a good unwanted signal sup-

Notes on diagram

C33 and C38 both 4-30. Adjust C33 and C38 to correct carrier frequency and R38 and R42 for the same output on both sidebands.
Adjust R53 so the no-load zener current is approx. 125 ma.
Adjust R54 so the emitter voltage under load is 9 volts.
* Indicates silver-mica capacitors.
L2, L3 and L4 are standard 10.7 mc transformers.
C12, C15 and C17 are selected so the circuit will resonate on 9 mc.
L1 2x5 turns bifilar wound on cold-end of L2, L5 3 turns on cold end of L4.
Unmarked capacitors are mmfd. N means x1000.


HIGH Z MIC
R1 47K
C2 10UF
R2 47K
C1 200PF
C3 10UF
C4 16UF
R3 100K
R4 10K
R5 47K
C5 10UF
AC151
AC151
R6 100Ω
R7 510K
R8 6.2K
C6 16UF
C7 16UF
C8 16UF
R9 100K AUDIO GAIN
R10 50K
R11 5K
R12 500Ω
C9 16UF
AC151
R.F.C. 1MH
C10 .001UF
OA79
OA79
R13 500Ω
C11 5-50 PF
9.0 MC
L1
L2
C12 50 PF
C13 5-30 PF
BROADBAND L8
L9
9 MC XTAL FILTER
R14 560Ω
R15 560Ω
L3
C15
9.0MC
C14 .001 UF
C18 .01UF
R16 100K
R17 10K
C16 .01UF
R18 1K
9.0MC
L4
C17
L5
AF114
R19 500Ω
C19 .01UF
RFC 1MH
C20 10PF
R20 1K
AF114
R21 1K
C21 .01UF
C22 .01UF
R22 33K
R24 3.3K
R23 3.3K
5J - 5.35MC L6
C23 3-30 PF
C24 50PF
C25 100 PF
C26 50PF
L7
C27 .01UF
C29 820 PF
C28 47PF
AF114
R25 33K
C30 .01UF
R26 1K
R27 33K
V.F.O.
OA150 OR EQUIVALENT GERMANIUM DIODE MIGHT SUBSTITUTE IN66
ANTI TRIP
C44 5UF
IN66
R28 50K
IN66
C43 5UF
R29 50K
R30 50K
IN66
IN66
C42 5UF
C40 5UF
R32 390K
R31 6.8K
AC151
C39 10 UF
R34 50K VOX GAIN
R33 1K
C41 10 UF
8.9985MC
AN114
R36 10K
C33
C34 100 PF
R37 1K
R35 50K
C31 50 PF
C32 50 PF
RFC 1MH
RFC 1MH
C35 .01UF
C36 .01UF
AN114
9.0015MC
C38
R39 1K
C37 100 PF
R41 50K
R40 10K
R38 500Ω
R42 500Ω
S2
SIDEBAND SELECTOR
R44 5.6K
OC72
OC72
R43 100K
R45 68Ω 1W
R46 22K
COIL 400Ω
TRANSMIT TUNE SWITCH
S4a
S4b
TRANSMIT RECEIVE SWITCH
S3a
S3b
PA MUTING
RECEIVER MUTING
S1a
S1b
SEC 48V. C.T.
2E4
2E4
C64 500UF 32V
R53 50Ω 3W
3Z1875
TF78/30
R54 2K
C65 500UF 32V
RFC 1MH
C47 .01UF
C45 .001 UF
RFC 1MH
3.5 OR 14 MC
80
L10
S5a
20
80
S5b
20
L11
AN114
R47 25K
C46 .01 UF
R48 1K
C48
C49 .01UF
C50 .01UF
C51 .01UF
C53 .01UF
80
3.5 OR 14 MC
S5c
20
AF114
R49 25K
C52 .01 UF
R50 1K
C54
RFC 1MH
RFC 1MH
C55 .01UF
C56
L12
3.5 OR 14 MC
L13
C57
80
S5d
20
L14
R51 2K
C58 .01UF
RFC 1MH
R52 50Ω
C59 .01UF
C60 .01UF
T2309
C61 .01UF
RFC 10MH
80
S5e
20
C62
L15
80
S5f
20
C63
ANT.

pression. In contrast to voltage-driven tubes, transistors may cause loading because they are power-driven. The selectivity is therefore much lower in a transistorized circuit than in a tube circuit. Consequently more tuned circuits are needed in a transistor rig to obtain a certain degree of selectivity than would be necessary in a tube circuit. Drive for the output transistor is taken from a small link L_{14} on the cold-end of the last coil L_{13} in the band-pass filter, and fed to the base of the transistor. This stage is also connected as a common emitter stage. The output circuit is a pi-network since it was the easiest to use. Impedance matching from the collector to the tuned circuit and further on to the antenna must be correct. If not, the stage will deliver a very distorted signal to the antenna. The author has had little success in calculating the proper values for the pi-network, so the values used were obtained by trial and error. In all but the last stage, the value of the base voltage divider or potentiometer is relatively uncritical, although lower resistance gives better stability. But in the final stage the potentiometer should not have greater than 2 kilohm resistance, or it would be difficult to get the stage to work as a linear amplifier. This is simply because the linear draws base current, and when used as a power amplifier, the change in base current is quite high. If the resistance in the circuit now is high, this will cause a great swing in base bias, resulting in distortion. By keeping the resistance low, a greater change in current can be allowed, without affecting the base bias. Remember that transistors are power driven, and will therefore draw base current when operating in class A, B and C.

As noted in the schematic, there is no tuning controls but the VFO. This is because it is possible to tune the rf amplifiers in such a manner that uniform gain is obtained in a band-pass of around 100 kc on 80 meters and around 400 kc on 20 meters, measured on a dummy load. Outside of the band-pass the gain drops off rapidly. This rig is tuned with a center frequency on 3750 kcs and 14175 kcs, and can cover 3.7 to 3.8 mcs and 14.1 to 14.35 mcs. The main SSB band in Europe is 3.7 to 3.8 mcs, but the transmitter can easily be tuned in the American phone band. However, only the range 3.8 to 3.9 mcs may be covered, without changing the values of the oscillator components. The output transistor, a Philco T 2309, delivers around 250 to 300 mw's output.

The Transistors

Little has been said about the transistors used in the transmitter; the reason is simply that the transistors the author used, might be difficult to obtain in the USA since they are made in Europe by Siemens. Furthermore it is quite difficult to find usable equivalent transistors, as may be seen from the variety of types in the Philco, Texas and PSI catalogues. Some data on the type of transistors used might help in selecting proper substitutes (See table I).

All germanium PNP types. OA 79 and OA 150 are rf germanium diodes with high back resistance. Almost any two matched diodes will do in the balanced modulator.

The VOX

It is not necessary to say much about the VOX circuit, since it has already been well covered in an earlier issue of this magazine. However, it might be necessary to mention the fact that the supply voltage to the VOX and audio stages must be quite stable in order to avoid troubles with self triggering. The first power supply used in this transmitter had a voltage drop of about 0.5 volt when the transmitter was activated. This voltage drop looked like a "one shot pulse" to the audio amplifier, and was amplified enough to be able to trigger the VOX stage. The pulse frequency was around 1 c/s., so this kind of trouble might be prevented by using a small coupling capacitor between the audio amplifier and the VOX amplifier, or by stabilizing the supply voltage. In fact, since the voltage for the oscillators must be stabilized, it is no extra trouble to stabilize the entire power supply.

Table 1

Suggested Replacement

AC 151 audio trans . col diss. 30 mw h_{fe} 60 — V_{cbo} 18 V. — OC71N — Amperex

AF 114 VHF trans . col diss. 50 mw h_{fe} 15 0— V_{cbo} 20 V. 2N2671 — Amperex

OC 72 audio trans . col diss. 100 mw h_{fe} 75 — V_{cbo} 32 V. — OC75N — Amperex

TF 78/30 audio trans . col diss. 3 W h_{fe} 50 — W_{cbo} 30 V. — 2N178 — Motorola or 2N176

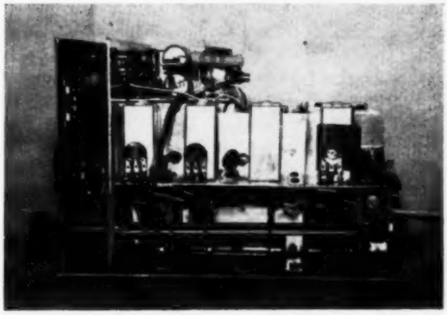
Mechanical Layout

Although it was decided to etch all circuitry, it was soon found that this type of mounting was excellent for making a neat and clean-looking construction, but not very useful when components had to be removed or changed. Instead, the rig was made by placing the different stages in small sub-chassis. This proved to be very useful when testing the different stages. The entire exciter measures approximately 6 by 9 by 11 inches. Although it is not a miniaturized rig, it could easily be made much smaller without affecting anything but the dial. A good and stable exciter is not worth much if you don't have a dial which can tell you your exact frequency, so the dial will determine how small the rig might be. The variable oscillator and the rf amplifiers should be carefully shielded to prevent pick-up and self-oscillation. All coils are housed in cans. The photos show how the different stages have been placed.

The Alignment

The alignment of the exciter begins with the power supply. First, adjust R_{53} so the no-load zener current is approximately 125 mA. Next, the transmitter is connected to the power supply. Be sure that the potentiometers R_{47} and R_{49} are set with the arm to the ground side, and R_{51} set with the arm to the negative side. Switch S_3 and S_4 to transmit, and adjust R_{54} so the voltage on the low-voltage line is around 10 volts. Later, when all amplifiers have been adjusted correctly, the control is readjusted so that the voltage is 9 volts. Now disconnect all stages but the audioamplifiers. All 3 stages should draw 3-4 ma at 9 volts. Connect a high-Z mike to the input and a pair of phones over the output terminals of the audio transformer with the balanced modulator disconnected. Speak into the mike and check for a good audio quality. If an audio generator and a VTVM is available then check the response. Be sure to have sufficient bass; the drop-off should be around 200 to 300 c/s., but not higher. The output with the gain control full clockwise should be at least 0.5 volt across a 500 ohm load.

The next stage to be checked is the VOX. First, apply collector voltage to the stages; next, adjust R_{43} so the relay just goes in the receiving position (great voltage drop across the relay coil). You will find the adjustment of the VOX balance (R_{43}) quite critical; set the potentiometers as near to the switch position as possible. Now advance the VOX gain (R_{34}) while speaking into the mike. If nothing is wrong the VOX relay will start to trigger. The delay might be adjusted slightly with the R_{30} and R_{43} potentiometers. Adjust the controls until a desired VOX operation is obtained. Under normal VOX operation the switch S_3 should be in the receiving position.


Looks into the rf amplifier section, note the heat-sink on the output transistor made of a piece of tinned iron bent around the transistor.

Now connect the two carrier oscillators in the circuit and connect a VTVM from the hot-end of L_9 to ground; check to make sure that both oscillators are oscillating. Place both trimmers C_{33} and C_{38} at full mesh. If a frequency meter or an accurate receiver on 9 mc is available, the correct positions of the carrier oscillators might be fixed with C_{33} and C_{38}. If these facilities are not available, the carrier oscillator will be fixed later when the rig is on the air in a ham band. Also adjust R_{38} and R_{42} so the two oscillators are giving the same output. Note! (this should not be done until the carriers are placed in correct relation to the filter).

If a high sensitive VTVM is not available, which is not likely to be the case in an amateur station, the next step will be to test and adjust the variable oscillator. Connect the oscillator and the buffer to the 9 volt line. If the oscillator is oscillating properly there should be around 2-4 volts of rf on the collector of the buffer transistor. Make sure that the oscillator is covering the desired range with a grid-dip meter or a receiver. As an example tune the oscillator so that the output frequency of the exciter will be 3.8 mc. The oscillator will then be on 5.2 mc. Switch the bandswitch to the eighty-meter position. Resonate with a grid-dipper or a transistor-dipper L_3 and L_4 to 9 mc, and adjust L_{10}-L_{12} and L_{13} to 3.8 mc. Set the collector current of the rf mixer to approximately 4 ma by R_{47}. Connect the receiver through a small capacitor to the hot-end of L_{11} and tune to 3.8 mc. Start to speak into the mike, and tune the receiver back and forth until you can hear the transmitter. Then adjust L_2 and C_{13} and readjust L_3 and L_4 for maximum signal and best quality. Adjust R_{13} and C_{11} for carrier null, and try to move C_{11} to the other side of the balance control if no result is obtained in carrier nulling. Adjust C_{33} for the proper sideband position, switch to the other sideband, and repeat the treatment with C_{38}. Readjust the carrier balance controls for maximum suppression on both sidebands. The setting of L_2 and C_{13} might affect the carrier balance, so adjust these once more.

Having come this far, you are pretty well on the way. Disconnect the receiver from L_{11}, and place a VTVM on the collector of the mixer. Peak the core to maximum output; also adjust R_{47} to maximum output (the adjustment of R_{47} might be more critical on twenty than on eighty meters). The rf voltage on the mixer collector should be 0.5 to 1.5 volts. Now connect the remaining amplifiers to the 18 volt line and a 50 ohm dummy load across the antenna terminal. Place a milliameter in series with the emitter of the T 2309. Place the VTVM from the hot-end of L_{14} and adjust L_{12}-L_{13} and R_{49} for maximum deflection on the meter (approximately 2-3 volts). Move the VTVM across the dummy load and connect also the receiver through a small capacitor to this dummy load. Listen to the receiver while slowly advancing the bias control R_{51}. At a certain setting the signal will change from highly distorted to a clear signal. Note the idler current (approximately 20 ma), and adjust $C_{62\text{-}63}$ and L_{15} for maximum output. The position of R_{51} will be found to be quite critical. You have now almost completed half of the tuning procedure; the only remaining thing to be done is to retune the rf amplifiers so it covers the desired range with a uniform output.

Repeat the entire procedure outlined above on 20 meters. The bias potentiometers should also be readjusted since they might be a little more critical on this band than on 80 meters. There should be no trouble in getting the exciter to cover the entire twenty meter band. If the shielding is good, there should be no trouble with parasitic or self oscillation.

Although the exciter has been designed for fixed use, it could very easily be modified for mobile use. Changing the 18 volt line to 12 volt should not affect the operation, but will of course give a somewhat lower output. To avoid frequency changing and drift in operation while driving, the oscillators should be fed from a dry battery or a pair of cascade coupled zenerdiodes.

The transmitter has now been in use for about one year and has shown very good operation facilities. The low power drain enables the rig to be tuned on at all times so the frequency stability can be even better. The author got the rather bad idea of placing the power supply on top of the oscillator section. And since the transformer generates some heat, this heating could affect the frequency stability. By leaving the power on at all times the temperature will be kept rather constant thus eliminating the warm-up drift. However the power drain is below 5 watts, so you don't have to bother about the electric bill.

. . . OZ7BQ

COIL DATA

L_1 4 + 4 turns bifilar wound on cold end of L_2.
L_2 one section of a standard 10, 7 mc if transformer.
L_3 same as L_2
L_4 same as L_2, L_5 base winding.
L_6 16 turns Airdux 816, collector taped 8 turns from the hot end.
L_7 3 turns on the cold end of L_6, spaced 2 turns.
L_8,L_9 broad-band transformer wound on a ferrite toroid L_8 12 turns, L_9 3 turns.
L_{10} 80 meters: 20 turns, taped 5 from hot end.
    20 meters: 14 turns, taped 5 from hot end.
L_{11} 80 meters: 4 turns.
    20 meters: 3,5 turns.
L_{12} as L_{10} on both bands.
L_{13} as L_{10} but no taping.
L_{14} 80 meters: 4 turns.
    20 meters: 2,5 turns.
L_{15} 80 meters: 25 turns.
    20 meters: 10,5 turns.
All coils are wound on a 8 mm form = 5 16", closewound with number 20 wire. The cores are all high permeability ferrite cores.

CAPACITANCE VALUES

C_{18}	80	meters	350	mmfd	20	meters	90	mmfd
C_{34}	80	meters	350	mmfd	20	meters	90	mmfd
C_{38}	80	meters	50	mmfd	20	meters	15	mmfd
C_{37}	80	meters	350	mmfd	20	meters	90	mmfd
C_{62}	80	meters	1000	mmfd	20	meters	250	mmfd
C_{63}	80	meters	3000	mmfd	20	meters	750	mmfd

Letter

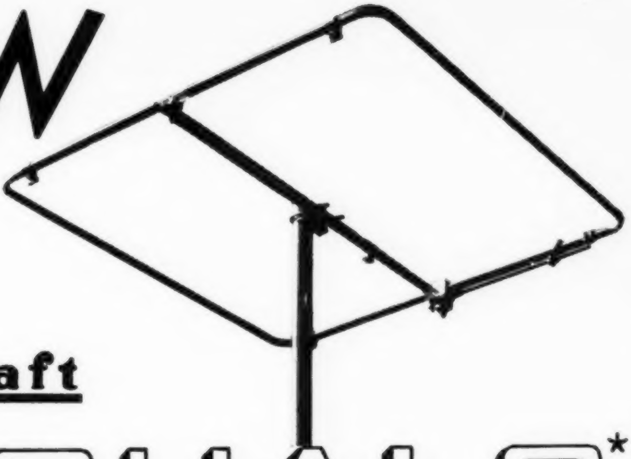
Dear Wayne:

Regarding my "Armstrong Sweeper" (April 73), it appears that it is not as obvious as I thought that one must use a scope with D.C. coupled horizontal input. Perhaps it might be wise to mention this in the Parts kit description.

A simple remedy for those who have an A.C. coupled horizontal amplifier might be to use the deflection plates directly, if they are available (D.C. coupled, of course, with no high voltage!). This naturally means increasing the supply voltage to the sweep pot. 100 volts seems to be a good choice, since it will dissipate 1 watt in the sweep pot and provide a reasonable deflection on a CRT with a sensitivity of 20 to 40 volts per inch. For less sensitive tubes the voltage must be increased accordingly. The sweep pot must also be changed to a higher value.

Albert E. Donkin, W2EM

NEW



Cush Craft

SQUALO*

6-10-11-15-20 or 40 METERS

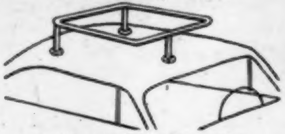
Cush Craft's continuing research produces another first —THE SQUARE HALO. Squalo is a full half wave, horizontally polarized, omnidirectional antenna. Outstanding all around performance is achieved through a 360° pattern with no deep nulls. Full size and compact dimensions provide a low Q for broad band coverage. Direct 52 ohm Reddi Match feed gives an SWR of 1.5-1 or less from 50 to 51 Mc.

The 6 and 11 meter Squalos are packaged complete with rubber suction cups for car top mounting and a horizontal support for mast or tower mounting. The 10-15-20 and 40 meter Squalos are designed for mast or tower mounting where space does not allow for larger antennas. Squalo is ideal for net control, monitoring, or general ham coverage.

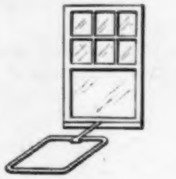
Whether you are a beginner, apartment dweller, or serious DX man the space saver Squalo is for you. You can buy one for each band and build a Squalo Tree!

Model No.	Description	Net Price
ASQ-6	6 meter 30" square	**$12.50**
ASQ-10	10 meter 50" square	**19.50**
CSQ-11	11 meter 50" square	**19.50**
ASQ-15	15 meter 65" square	**23.50**
ASQ-20	20 meter 100" square	**29.50**
ASQ-40	40 meter 192" square	**66.50**

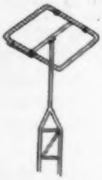
ON YOUR CAR



OUT A WINDOW



ON A MAST

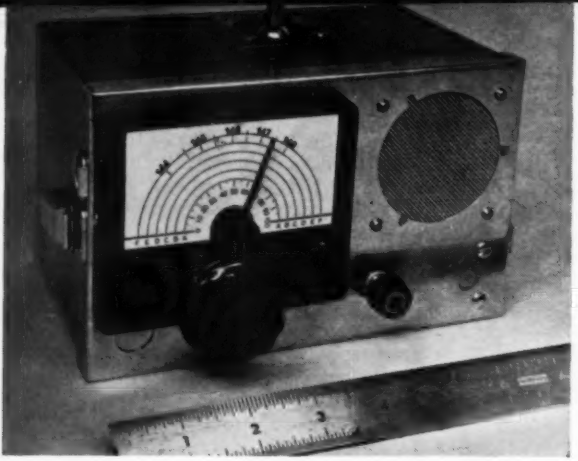


*Pronounced Squaylo

Cush Craft

621 HAYWARD ST.
MANCHESTER N. H.

BUY FROM YOUR DISTRIBUTOR OR WRITE FOR FREE LITERATURE



Walt Pollind K6TOV
5661 Elinora Lane
Cypress, Calif.

Two Meter Transistor Receiver

If you like to travel light, here is a compact, all transistor, 2 meter receiver that can be used fixed, portable, or mobile. The receiver uses 9 transistors: rf, mixer, oscillator, 3 *if* stages, a driver and class B output amplifier. Frequency coverage is 143 mc to 150 mc. *If* frequency is 10 mc and the overall 3 db bandwidth of the *if* amplifier is 50 kc. The receiver operates on 12 volts and total current drain is 20 ma, which makes it ideal for portable operation.

Since the receiver operates on 12 volts, it can be readily adapted for mobile use. For fixed operation, batteries or a separate power supply could be used. I am using 3, 4 volt Mallory Tr-133R, mercury batteries in series. The unit is housed in a box 7⅛" × 4½" × 4 11/16" deep.

Performance

The receiver has good sensitivity across the entire band, approximately 1 micro-volt. Selectivity is good since careful attention was given to matching in the rf and *if* stages. The receiver has a noise figure of approximately 3 to 4 db.

I have compared the receiver with a good converter and communications receiver and it really holds its own and better.

About The Circuit

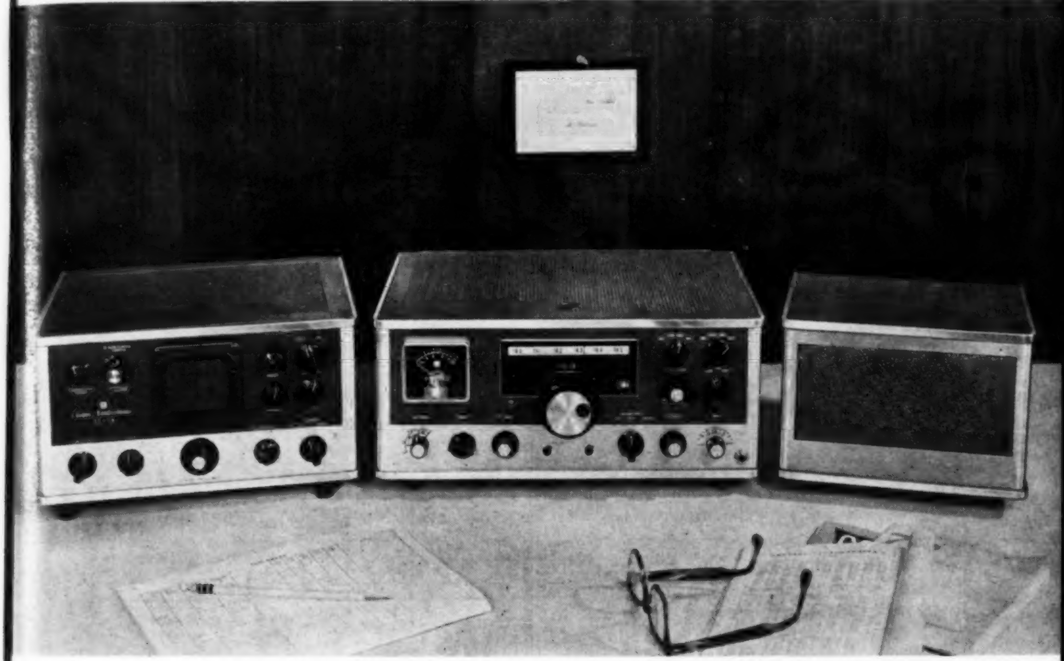
The rf amplifier is a common emitter stage, using a PNP Sprague 2N1742 or Amperex 2N2495 transistor. This transistor was designed for operation in the frequency range of 30 to 800 mc, and is capable of 20 db of gain at 150 mc. The rf stage is not tracked but is peaked up at the center of the band, 146 mc. Only the mixer and oscillator are tracked.

The 2N1742 or 2N2495 is also used in the common base oscillator. Feed-back is furnished by capacitor C 39 from collector to emitter. The oscillator is tuned below the incoming signal.

The mixer transistor is a Sprague PNP 2N-1743 or Amperex 2N2084 designed for mixer operation in VHF applications. A series trap is connected to the base of the mixer to insure a low impedance at the *if* frequency. The use of the trap improves image rejection. Capacitor C 8 and a 3.3 micro-henry choke make up the series trap. Base injection is used in the mixer.

The *if* amplifier uses 3 (RCA) PNP 2N1180

SS-1R, SS-1S, SS-1T, SS-1TF.....



THE SQUIRES-SANDERS family of HF amateur equipment—which started with the announcement last fall of a genuinely new approach to HF receiver design and performance (SS-1R) and original developments in noise silencing techniques (SS-1S) continues to grow. The original objective of a complete HF amateur *system* which is unsurpassed in quality and performance will soon be realized. The SS-1R receiver, SS-1RS matching speaker, and SS-1S noise silencer are currently available. The superb performance of this receiver and silencer—especially in frequency accuracy, rejection of strong adjacent signals, and the spectacular elimination of impulse noise (plus really fine construction)—has been talked about by hams the world over.

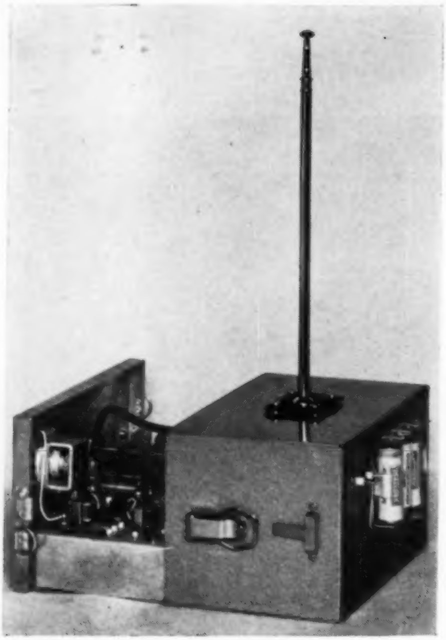
The SS-1V Video Bandscanner (see photo, left) is just as unusual as its predecessors. This unique oscilloscope display unit, when used with the SS-1R, shows all signals in the band in use, or any portion of the band can be expanded to full screen for detailed examination. Both linear and logarithmic displays are provided. A unique feature is that the *signals displayed do not move as the receiver is tuned*, but a marker pip constantly shows the exact frequency to which the receiver is tuned. The sharp resolution of this unit permits observation and measurement of two AM sidebands displaced only 2.5 kc. from the carrier. In addition provision is made for transmitter monitoring or analysis with automatic switching on "transmit."

The matching transmitter—SS-1T—has been released for production also and will be available shortly after the Bandscanner. Designed for transceive mode operation with SS-1R receiver frequency control, SS-1T will operate at 200 watts PEP input and will embody still other unusual Squires-Sanders developments which provide operating features not available in similar equipment. Complete specifications and operating characteristics will be published shortly. For those operators who prefer separate receiver/transmit frequency control, the separate transmit frequency unit (SS-1TF) will be available. Keep in touch with your distributor or write for further detail.

AMATEUR NET PRICES: SS-1R Receiver, $895; SS-1RS Speaker, $35; SS-1S Noise Silencer, $135; other prices to be announced.

Squires-Sanders, Inc.

475 WATCHUNG AVENUE, WATCHUNG, N.J. • 755-0222



transistors; all 3 stages are connected as common emitter amplifiers. The first and second *if* stages are neutralized. Gain of approximately 18 to 19 db per stage is obtained at 10 mc. AGC is applied to the first *if* amplifier, Q 4.

If desired, an rf gain control can easily be added (see Fig. 3).

Construction

Front panel dimensions are 7 5/16" × 4⅜". Components are mounted on a cadmium plated brass chassis, 6¾" × 4⅜" × 1½". Thin brass material was used for shielding and in the rf and *if* stages the shields were soldered in place. If an aluminum chassis is used, shields and ground lugs can be secured with hardware. Solder-type capacity feed-thrus were used in the unit, however, the threaded type may be used if desired. For stand-offs and feed-thrus, the small teflon type were used.

Construction can begin with the front end. The tuning capacitor, C 4, is a 3 gang variable, only 2 sections being used. Remove all but 2 plates from each section, one rotor and stator remaining per section. A dual section variable can be used for C 4 if desired.

Mount the tuning capacitor, C 4, approximately as shown in Fig. 1. Next the rf and oscillator sockets, (Elco no. 3307), should be located as close as possible to the tuning capacitor, C 4, (see Fig. 1). The rf and oscillator transistor sockets, (Elco no. 3307), are the 4 pin type, since the Philco T-2028 has 4 leads: base, emitter, collector and shield.

Capacity feed-thrus, C 22, C 23, C 38, C 41, are located as shown in Fig. 1. The emitter bypass, C 6, is a stand-off feed-thru type capacitor; the button type or a capacitor feed-thru can be used. C 6 should be located close to the emitter lead of Q 1.

Before mounting L 1, solder a 1 inch length of number 22 bus wire, ½ turn up from the cold end of L 1. This will be the antenna tap. Solder another 1 inch lead 1 turn up from the cold end; this tap goes to the base of Q 1. L 1 can be secured in place by soldering the cold end directly to the capacity feed-thru C 22. Solder C 2 and C 3 across L 1. The shield for Q 1 can then be secured in place. The cold end of L 2 is soldered to C 23; the other

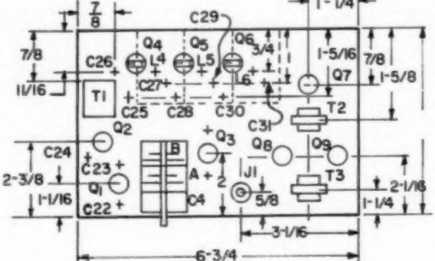

7/8
7/8
1-1/4
C29
Q4
Q5
Q6
3/4
1-5/16
7/8
1-5/8
C26
L4
L5
L6
Q7
11/16
T1
C27
C25
C28
C30
C31
T2
Q2
Q3
Q8
Q9
C24
B
C23
A
2
J1
T3
2-3/8
Q1
2-1/16
1-1/16
C22
C4
5/8
1-1/4
3-1/16
6-3/4

FIG. 1

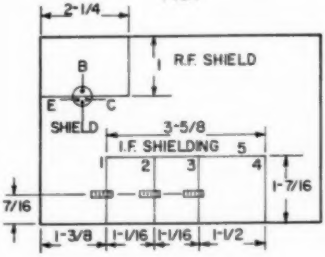

2-1/4
R.F. SHIELD
B
E
C
SHIELD
3-5/8
I.F. SHIELDING
5
1
2
3
4
1-7/16
7/16
1-3/8
1-1/16
1-1/16
1-1/2

FIG. 2

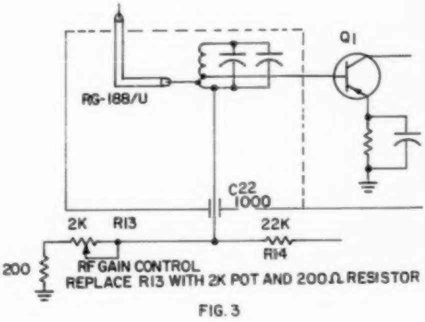

Q1
RG-188/U
C22
1000
2K
R13
22K
R14
200
RF GAIN CONTROL
REPLACE R13 WITH 2K POT AND 200Ω RESISTOR

FIG. 3

Detroit, Michigan: "Does an excellent job of swinging a 20-40 combination and stacked Finco 6-2 beam."

San Diego, California: "I am well pleased with the rotor to date, holds and turns stacked 40M and up beams in 50 mph winds with no difficulty."

Los Angeles, California: "I have personally installed 3 other HAM-M Rotors in the past 3 years (all of them OK) so I feel that I'm buying the best."

Houston, Texas: "Wonderful! Was using the AR-22 (the CDE TV automatic) and it did a fine job for 4 years, but put up a larger beam and needed more power."

Anchorage, Alaska: "Due to below-zero weather, it took quite a while to get up but the last couple of weeks it has proved perfect. Wish I had one years ago."

Alamo, California: "Works very well and purchased on recommendation of my friend who has been using one for 4 years and likes it quite well."

Swarthmore, Pa.: "Am very pleased with the results. More than meets my expectations."

Pluckemin, New Jersey: "The HAM-M rotates and two TR-15's tilt the 6-foot parabola for 432 and 1296 mc."

Chicago, Illinois: "It really does the job."

New York, N. Y.: "This is a perfect rotor. Can't see where you can improve it."

(a sampling of mash notes received by our HAM-M)

At $119.50 amateur net, the HAM-M is the greatest rotor value around! For technical information, contact Bill Ashby K2TKN. Your local CDE Radiart Distributor has the HAM-M in stock.

CDE CORNELL-DUBILIER

CORNELL-DUBILIER ELECTRONICS, DIV. OF FEDERAL PACIFIC ELECTRIC CO., 118 E. JONES ST, FUQUAY SPRINGS, N. C.

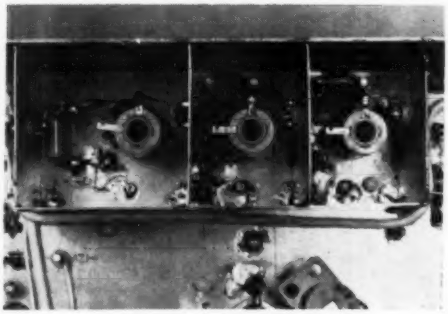
CDE makes a complete line of the world's finest rotors: Ham, heavy-duty automatic, heavy-duty manual, standard-duty automatic, standard-duty manual...and the industry's only wireless remote control rotor system!

THE BIG SIGNAL!

SWAN-400
SWAN

ask the ham who owns one! SEE THE SWAN 400 AT YOUR SWAN DEALER **NOW!**

SWAN ELECTRONICS CORP.
Oceanside, California



end to the collector lead of Q 1. Then run a lead from the collector of Q 1 to C 4A. Keep lead lengths short.

Oscillator coil L 3 is secured in place the same as L 2. The cold end is soldered to C 41, again keeping lead length short. The 3-12 mmfd trimmer capacitors can be located as shown or mounted on the tuning capacitor C 4. The mixer is located close to L 2 so that lead length for coupling capacitor C 7 can be kept short.

Mount the *if* transformer, T 1, as shown in Fig. 1. Locate the *if* transistor sockets (Elco no. 803-BC) and capacity feed-thrus. Before mounting the shields across the sockets (Fig. 2) install the 2 feed-thrus that connect the neutralizing capacitors, C 11 and C 15. *If* coils L 4, L 5, and L 6 are installed last. Leave the side shield off until you have completed wiring the *if*.

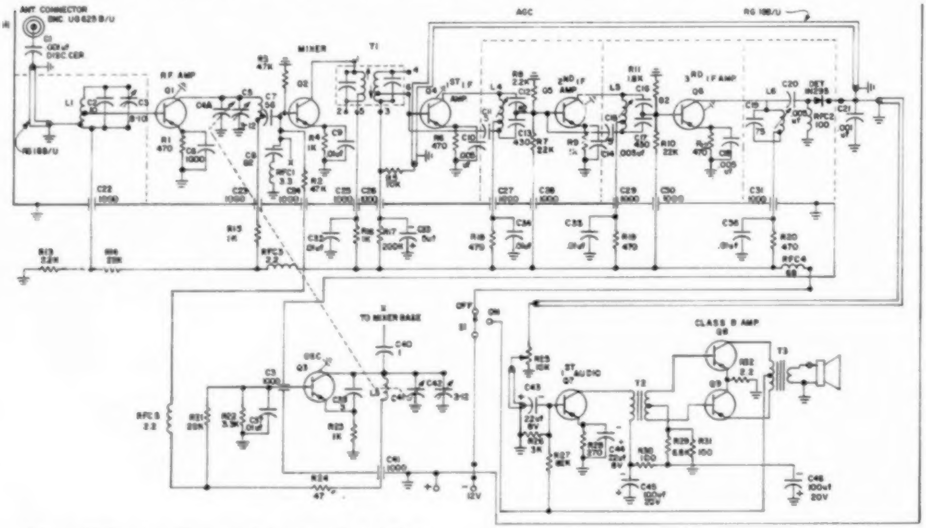
Last but not least, the audio section can be located approximately as shown in Fig. 1. Transistor sockets used for the mixer and audio section are Elco no. 3301.

Tuning Up

The rf amplifier is adjusted first. Install transistor Q 1; with voltage applied and tuning capacitor C 4 fully open, couple the grid dip meter near L 2; adjust trimmer capacitor C 5 for a dip at 150 mc; close C 4 and adjust L 2 by squeezing or spreading the turns for a dip at 143 mc. If after doing this several times, you find difficulty in covering the tuning range at the high end, the rotor plate, C 4A, may be bent out slightly, reducing capacity.

The rf amplifier can be adjusted with a signal generator and rf voltmeter. Connect the generator to antenna connector J 1; connect the rf probe to the base of mixer Q 2, and using the same procedure as above adjust for a peak at the high and low end.

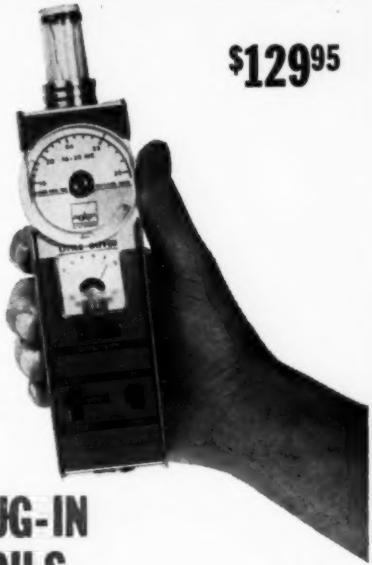
Next install oscillator transistor Q 3. With voltage applied, tuning capacitor C 4 fully open, with the grid dip meter in the diode position and loosely coupled near L 3, adjust trimmer capacitor C 42 for a peak on the grid dip meter at 140 mc; close C 4 and adjust L 3 for a peak at 133 mc.


ANT CONNECTOR
BNC UG625B/U
C1 .001uf DISC CER
RG188/U
L1
C2
C3
RF AMP
Q1
R1 470
C6 1000
C4A
C5
C7 56
MIXER
Q2
R3 47K
R4 1K
C9 .01uf
C8
RFC1 3.3
R2 47K
T1
AGC
1ST IF AMP
Q4
R6 470
L4
R8 2.2K
C12
C13 430
R7 22K
2ND IF AMP
Q5
R9 1K
C14 .005uf
L5
C16
C17 430
R11 18K
R10 22K
3RD IF AMP
Q6
R12 470
L6
C19 75
C20
DET 1N295
RFC2 100
C21 .001 uf
RG 188/U
C22 1000
C23 1000
C24 1000
C25 1000
C26 1000
C27 1000
C28 1000
C29 1000
C30 1000
C31 1000
R13 2.2K
R14 22K
R15 1K
RFC3 2.2
C32 .01uf
R16 1K
R17 200K
C33 5uf
R18 470
C34 .01uf
C35 .01uf
R19 470
C36 .01uf
R20 470
RFC4 68
TO MIXER BASE
C40 1
OSC
Q3
C3 1000
L3
C42 3-12
RFC5 2.2
R21 20K
R22 3.3K
R23 1K
C41 1000
R24 47
OFF
ON
S1
+
−
12V
CLASS B AMP
Q8
Q9
R32 2.2
T3
1ST AUDIO
Q7
R25 10K
C43 22uf 6V
R26 3K
R27 18K
R28 270
C44 22uf 6V
T2
R30 100
R29 6.8K
R31 100
C45 100uf 20V
C46 100uf 20V

Note: Philco is still manufacturing their VHF transistors. The new number for T-2028 is 2N2398 and the 2N1743 is now the 2N2361. Th eSprague 2N1743 will do just fine for the mixer. The 2N2398 will do a little better than the PNP 2N1742 or 2N2495 for the rf amp and osc.

All capacitors mmfd unless marked. All resistors in ohms, ¼W unless marked. All inductors in microhenries unless marked.

LITTLE DIPPER

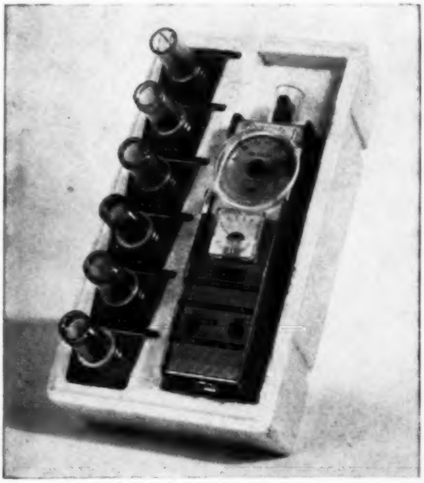


$129.95

Transistorized. Built in tone modulator.
Uses four penlight cells.
Performs functions of a grid dip oscillator, absorption wavemeter and signal generator.

PLUG-IN COILS

Covers from 2-230 mc in 7 bands. Each plug-in coil has its own dial calibration.



MOULDED PLASTIC CASE

Polyfoam carrying case for Dipper and coils.

HOW ABOUT THAT?

We also make these:

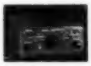
Electronic Vernier Tuning for KWM-2/2A.

Q-Multiplier Notch filters to fit all Collins equipment.

Channelator.

Coax Switches now available in four models — SPDT, DPDT, SP6T, Transfer.

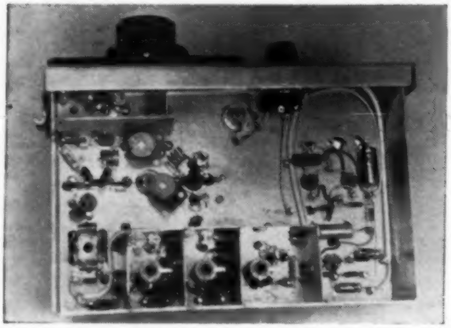
Hybrid Coupler Compression Amplifier Phone Patch and Tape Recorder Patch.



Dummy (no offense) Load Wattmeter.

WATERS MFG. INC.

WAYLAND
MASS.



The *if* amplifier is peaked up with a signal generator at 10 mc. Connect the generator to the base of the mixer, Q 2, through a 10 mmfd capacitor. With the generator in the rf modulated position, peak up T 1, L 4, L 5, and L 6 for maximum signal at speaker. L 1 can be peaked up on a signal at 146 mc by adjusting trimmer capacitor, C 3, .8-10 mmfd.

Take your time and make it neat, I know you will be pleased with the results. Compare the receiver with other equipment and I know you will agree that transistors have their place in VHF. Good dx-ing.

. . . K6TOV

PARTS LIST

Capacitors
C 1, C 21—.001 mfd-disc. cer.-50V
C 2—10 mmfd-dura-mica El-Menco
C 3—.8-10 mmfd—trimmer—Johnson or JFD
C 4—tuning capacitor—see text
C 5, C 42—3—12 mmfd—trimmer—Erie
C 6—1000 mmfd—Stand off capacitor—see text
C 7—56 mmfd—dura mica—El Menco
C 8, C 12, C 16—82 mmfd—dura mica—El Menco
C 9, C 32, C 34, C 35, C 36, C 37—.01 mfd disc. cer. 50 V
C 10, C 14, C 18, C 20—.005 mfd—disc. cer. 50 V
C 11, C 15—5 mmfd—dura mica—El Menco
C 13, C 17—430 mmfd—dura mica—El Menco
C 19—75 mmfd—dura mica—El Menco
C 22, C 23, C 24, C 25, C 26, C 27, C 28, C 29, C 30, C 31, C 38, C 41—1000 mmfd—feed thru capacitor—see text
C 33—5 mfd 12 volt
C 39—3 mmfd—dura mica—El Menco
C 40—1 mmfd—dura mica—El Menco
C 43, C 44—28 mfd 8 volts
C 45, C 46—100 mfd 20 volts
RFC—1—3.3 micro-henry
RFC—2—100 micro-henry
RFC—3, 5—2.2 micro-henry
RFC—4—68 micro-henry
S1—part of R 25, 10K pot—Calrad
J1—Ant. connector—BNC—UG 625 B/U
T2—driver Xmfr—10,000 ohms to 2000 ohms C.T.—Calrad CR-70
T3—output Xmfr 500 ohms C.T. to 3.2 ohms—Calrad CR-80
Transistor Sockets—see text
Dial—Millen-type 10039

Transistors
Q 1—RF amp. (Sprague PNP 2N1472) or Amperex 2N2495
Q2—mixer (Sprague PNP 2N1743) or Amperex 2N2084
Q 3—Osc. (Sprague PNP 2N1472) or Amperex 2N2495
Q 4, Q 5, Q 6—*If* amp. RCA PNP 2N1180
Q 7, Q 8, Q 9—Audio amp. RCA PNP 2N270

Coil Table
L 1—5 turns no. 18 solid 3/16" dia. Antenna tap, up ½ turn from cold end. Base tap, up 1 turn from cold end.
L 2—3 turns no. 18 solid ¼" dia. tapped up ½ turn from cold end.
L 3—4 turns no. 18 solid
L 4, L 5, L 6—26 turns no. 28 enamel covered wire wound on Cambion PLS-6 coil form ¼" dia. red slug tap up 3 turns from bottom end Cambion coil form Cambridge Thermionic Corp.
T 1—transistor *if* Xmfr No. 1601 (J. W. Miller Co.)

Stripping Transistor Radios

John Walters K8YCH
1328 E. 26th Ave.
Columbus, Ohio

A trip to your local transistor radio dealer will turn up a bunch of two transistor radios that do not work. At their selling price ($4 to $6) the dealer cannot spend much time trying to repair them. So he will probably be more than glad to sell them cheap. I picked up eleven for seventy cents per radio. There is a lot of variation in the circuit of these radios, but most of them use one stage of rf, reflexed rf-af, then one stage of audio. Of the eleven radios I picked up, six of them had simple troubles. Bad switch, open ear phone jack, break in the board, open wire on battery plug, etc. The other five had an open reflex coil, a broken variable capacitor, a bad transistor, or a broken board. By stripping the parts out of these, I found I had out of each radio: two transistors (one that was good at least 1600 kc and one audio type), one driver transformer, one output transformer, one speaker, two to four electrolytic capacitors, two to four ceramic or paper capacitors, three to six fixed resistors, one variable capacitor, and one variable resistor with switch (most of these were 5000 ohms), one loop stick antenna, one reflex coil, one case, and miscellaneous hardware. By using the parts of these radios you can make the following:

1. A *code osc.* (See Fig. 1.) The setting of the pot will determine the frequency of osc.; also, the value of the capacitor will affect it. Somewhere in the range of the pot it will oscillate. If it won't, reverse the winding on the secondary of the transformer.

2. A *speaker mike.* (See Fig. 2.) The value of R is such that ½ the supply voltage will

be dropped across the load resistor. Use the radio with a 3 or 3½″ speaker for best results.

3. *An rf oscillator or bfo.* (See Fig 3.) By using this as a test oscillator I fixed some of the other radios. The value of R will change the wave shape. Too low a value will give a very peaked wave, while a high value will give a square wave. Somewhere in between 50 and 100 K ohms you should get a nice sine wave. By putting posts on the points marked X you can make an rf transistor checker. By putting the right value of condenser in parallel with the variable, you have a bfo. This has been used with a no name type short wave receiver for code practicing. I have used one of the 3″ speakers on my receiver.

These are only three applications. There are many more. I'm working on an intercom and also a phone patch. In this day and age of high prices it sure is nice to be able to build and play around cheap. As for the radios that did work, my wife, my son, and my in-laws all have one. I have traded one for a coaxial relay and I still have some for trading purposes.

So go to it. You can't lose much money, you might make some. You'll learn more about transistors, and you might have some mighty cheap Xmas presents for some boy or girl.

Any other applications you might come up with let me know!

. . . K8YCH

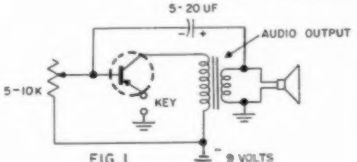


FIG. 1

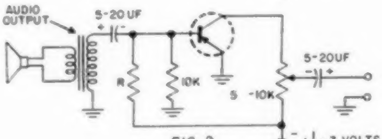


FIG. 2

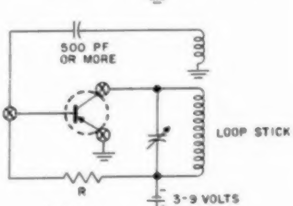


FIG. 3

ROHN
sets the standard
for CRANK-UP TOWERS
Why settle for less than the best?

K7ASK

TWO CATEGORIES TO CHOOSE FROM

Standard Duty Guyed in Heights of 37 - 54 - 88 - 105 and 122 feet

Heavy Duty Self Supporting and Guyed in Heights of 37 — 54 feet (SS) 71 — 88 feet (guyed)

ROHN has these 6 IMPORTANT POINTS:

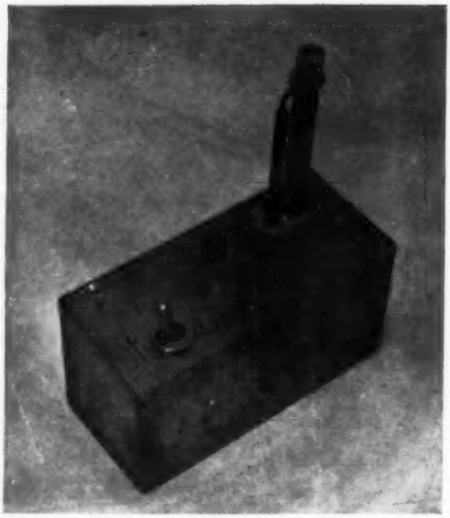
Ease of Operation—roller guides between sections assure easy, safe, friction-free raising and lowering. **Strength**—welded tubular steel sections overlap 3 feet at maximum height for extra sturdiness and strength. Unique ROHN raising procedure **raises all sections together**—uniformly with an equal section overlap at **all** heights! **Versatility**—designed to support the largest antennae with complete safety and assurance **at any height desired! Simple Installation**—install it yourself—use either flat base or special tilting base (illustrated above) depending on your needs. **Rated and Tested**—entire line engineered so you can get exactly the **right** size and properly rated tower for **your** antenna. The ROHN line of towers is **complete. Zinc Galvanized**—hot dipped galvanizing a standard—not an extra—with all ROHN towers! Prices start at less than $100.

SEND FOR ROHN TOWER HANDBOOK —$1.25 Value —ONLY $100 postpaid *(special to readers of this magazine).* Nearest source of supply sent on request. Representatives world-wide to serve you. Write today to:

ROHN Manufacturing Co.

P. O. Box 2000 **Peoria, Illinois**

"World's Largest EXCLUSIVE Manufacturer of Towers; designers, engineers, and installers of complete communication tower systems."



Simple Transistorized Beacon Source for 144,432, and 1296

H. M. Meyer, Jr. W6GGV
260 West Beach Ave.
Inglewood, Calif.

Often during the alignment of receivers and the general check out of equipment and antennas, a signal source is required to make sure you've located yourself in the exact part of the spectrum you intended. The beacon source described here is designed to fulfill that requirement with a minimum of trouble and a maximum of usefulness. To begin with, it should be readily portable with a self-contained power supply, small, operate on a fixed frequency, have an adjustable output level and be inexpensive and easy to build.

Satisfying these requirements posed some rather interesting problems and resulted in several hours of construction time that has proven to be well spent.

Circuit

The crystal oscillator circuit uses a Philco 2N502 transistor in an overtone circuit with a 72 mc crystal. A McCoy miniature crystal unit was used to conserve space, but there is more than enough room to use a standard size unit. The choice of frequency gives a second harmonic marker at 144 mc, a sixth harmonic marker at 432 mc and a multiplied final output at 1296 mc. If you are more interested in 6 meters than 2 meters, use a 54 mc crystal—this gives you output on the fundamental 432 mc and 1296 mc. The 2N502 transistor was used because it was available here. It is a little more expensive than some other types that would perform equally well. The circuit is straightforward and subsequent substitution of other types has yielded essentially the same performance.

The oscillator circuit supply voltage is regulated with a small zener diode through a dropping resistor to provide a bit more in the way of frequency stability. The output of the oscillator is fed directly to a diode multiplier and tuned by a $\frac{\lambda}{2}$ line tank tuned to 1296 mc. Even though the multiplication factor is 18, there is sufficient output at 1296 mc to completely quiet a 1296 mc diode mixer type converter and a 432 mc receiver. The multiplier diode, a OK 733, is one that was salvaged from a standard coil UHF TV plug-in strip that was picked up for next to nothing in a local surplus store. The DR 404 that is commercially available for about a dollar works just as well.

The entire unit is powered by a 15 volt dry battery (Burgess U10) and has a relatively long life in this service provided you remember to turn it off when you are through.

The only controls and adjustments that appear on the outside are the 1296 mc tank tuning, the on/off switch and the output jack

Solid-Signal SSB

SUMMER SPECIAL

HAMMARLUND offers an EV 664 ELECTRO-VOICE MICROPHONE

ABSOLUTELY FREE!

HX-50
$449.00

Here's a combination you simply cannot afford to pass up. As an *August Only* Summer Special your local Hammarlund Distributor will give you an EV 664 microphone free with the combined purchase of a Hammarlund HX-50 SSB Exciter and the Booming 1 KW HXL-1 Linear Amplifier.

No "ifs", "maybe" or boxtop needed—simply present yourself to your local distributor to see and try this outstanding equipment, and cart away the biggest Ham Bargain of the year!

HXL-1
$399.00

Offer expires Aug. 31, 1964

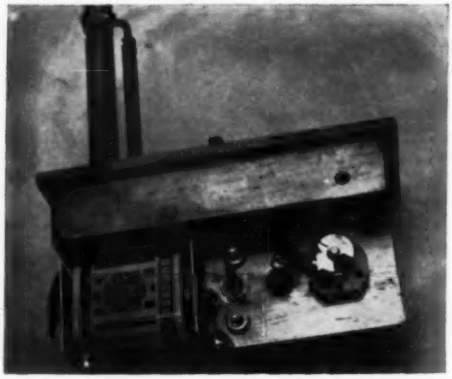
EXTRA BONUS

Also receive the famous W9IOP Dx-Computor

Established 1910

HAMMARLUND
MANUFACTURING COMPANY
A GIANNINI SCIENTIFIC COMPANY

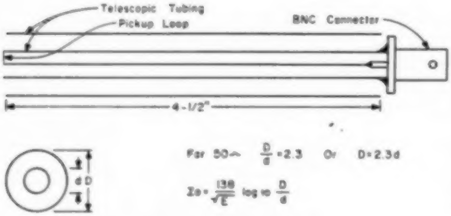
53 West 23rd Street, New York 10, New York



and attenuator. The attenuator is the device that makes the unit extremely flexible and useful. Therefore, a bit of careful attention to its construction will really pay off in the long run. Fundamentally, it is a simple coaxial attenuator using loop pick-up. It is designed for a characteristic line impedance of 50 ohms and the appropriate values of telescopic tubing were chosen to give a snug fit consistent with the proper diameter required for the center conductor.

An essential part of the attentuator is the guide that maintains the probe coupling in a fixed plane. The guide rod and sleeve technique used here is satisfactory and other methods are left to the ingenuity of the constructor. The pick-up sleeve is made long enough so that when it hits the guide stop, the pick-up loop is almost in contact with the center conductor of the line tank and parallel to it.

You can use whatever size telescopic tubing that is available or pick some up at the local hobby shop provided care is taken to keep the ratios of the inside diameter of the outer conductor to the outside diameter of the inner conductor as close to 2.3 as possible. (See Fig. 1.) If other values of impedance are desired, they can be calculated from the formula given in Fig. 1.


Telescopic Tubing
Pickup Loop
BNC Connector
4-1/2"
d
D
For 50∼ $\frac{D}{d}=2.3$ Or $D=2.3d$
$Z_0=\frac{138}{\sqrt{\epsilon}}\log_{10}\frac{D}{d}$

COAXIAL ATTENUATOR
FIGURE 1

If good laboratory equipment is available, the movable part of the attenuator may be calibrated in db as a further refinement, but it is not necessary for completely satisfactory use.

Construction

The entire unit is housed in a brass box 2" wide by 2½" high by 4 ⅜" long. This can be readily bent up from .03 sheet stock in a moderate sized vise. There is no strict requirement on the type of material used as long as reasonable care is taken to shield the energy that is generated. When the box is formed to proper shape, solder the corners carefully and a shielded strong unit results.

The top plate mounts all the hardware and was made from a piece of sheet brass 2" wide by 4 3/8" long by 1/8" thick. It could just as well have been made from other material since the only requirement is that it be rigid enough to support the components and attenuator. The only purpose for using such relatively thick stock for the top plate was to provide enough material to drill and tap this plate to anchor the shield can. Thinner stock could readily be used if ¼" lips were bent on the four sides. See Fig. 4.

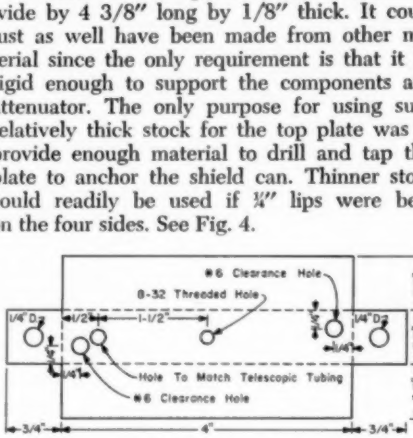


FIGURE 2

The entire unit is designed to be hand held and operable leaving the other hand free for adjustment of other equipment.

The next piece to fabricate is the $\frac{\lambda}{2}$ line tank for 1296 mc. This was also bent from .030 sheet brass stock so that an open trough measuring ¾" by ¾" by 4" resulted. The corners are soldered for rigidity and holes drilled before bending as indicated in Fig. 2.

Tuning for the tank is accomplished by using an 8-32 bolt with a small disc 3/8" in diameter soldered on the end that comes in close proximity to the center conductor. The top plate is threaded and tension is provided by a nylon nut at the top. Be very careful when soldering the disc on the end of the bolt to make sure the nylon nut is flush up against the bolt head and do not disturb the

NEW
ALLIANCE TENNA-ROTOR®
for Ham Installations

The patented-rigid-offset design distributes the load over a greater area and gives the rotator a superior strength to weight ratio. Ideal for use with amateur multiband tribander type antennas.* This compact unit is stronger and lighter, therefore making it safer and easier to install. The Rotator unit is fully enclosed in a weatherproof, strong ribbed die-cast zinc housing. An important performance feature is the combination of the worm gear and magnetic brake, which has a high resistance to windmilling.

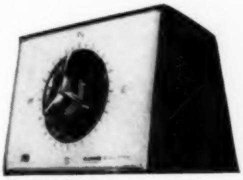
The completely transistorized Model C-225, solid state control features a patented phase-sensing electronic bridge circuit. All you do is turn the knob and the antenna will automatically sync to that direction.

If you can lift and mount your antenna on the Tenna-rotor, it will support it, hold it, and turn it.

*Recommended mounting one foot maximum above the rotator.

For complete details write: UL Listed & CSA Approved

The ALLIANCE Manufacturing Company, Inc.
(Subsidiary of Consolidated Electronics Industries Corp.) ALLIANCE, OHIO



Model C-225

nut until the unit has completely cooled.

Next insert the center conductor. This is cut from ¼" round tubing and just long enough to pass beyond the end plates of the tank. The center conductor is soldered in place and the additional material left sticking out is carefully filed off to make a neat flat surface.

A small L bracket was used to mount the battery and the tuning capacitors and provide shielding between the circuits. The dimensions for this are shown in Fig. 3.

After all the pieces are fabricated, mount the 1296 tank to the top plate using 6-32 screws. Use short 6-32 binding head screws with the head side in the tank. Next mount the outer conductor of the attenuator from the top of the plate so that it is flush with the inside of the tank. Solder this in place on the *top* side. Next mount the L bracket with battery clip and tuning capacitors, make sure that the on/off switch has proper hole clearance and bolt it down.

The unit is now ready for wiring. To aid in the placement of parts miniature tie points were used in conjunction with stud mounted by-pass capacitors to support all components.

The original unit constructed used a ferrite slug coil form. This was subsequently replaced by air wound coil when it was determined that a significant amount of frequency instability resulted from its use.

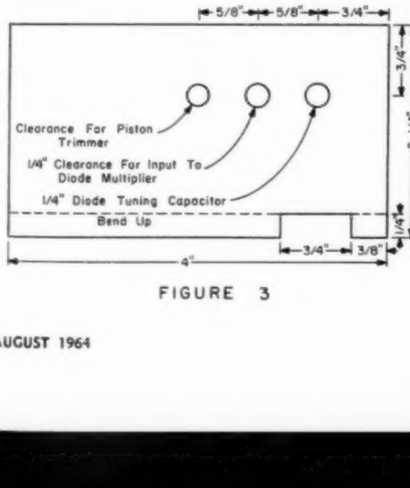

5/8"
5/8"
3/4"
3/4"
2-1/4"
Clearance For Piston Trimmer
1/4" Clearance For Input To Diode Multiplier
1/4" Diode Tuning Capacitor
Bend Up
1/4"
3/4"
3/8"
4"

FIGURE 3

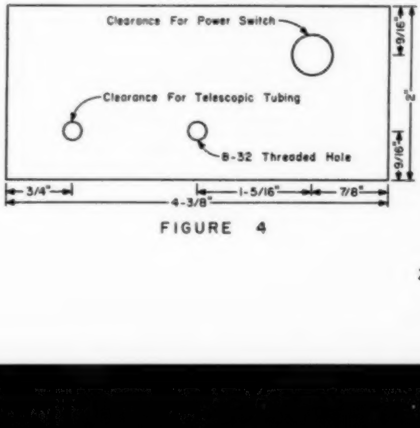


FIGURE 4

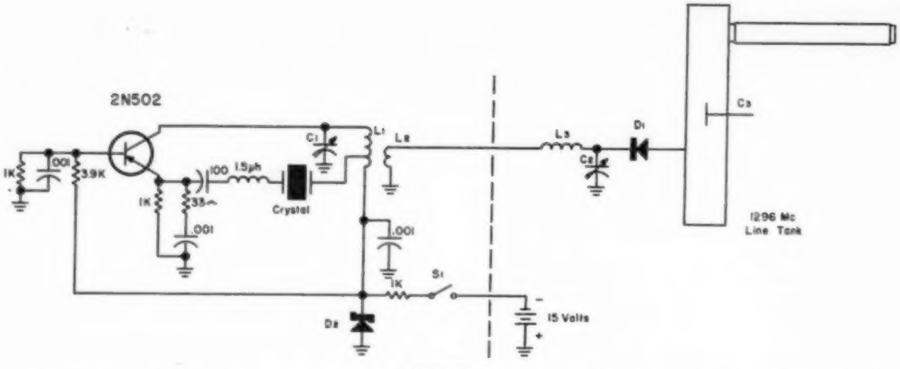


FIGURE 5

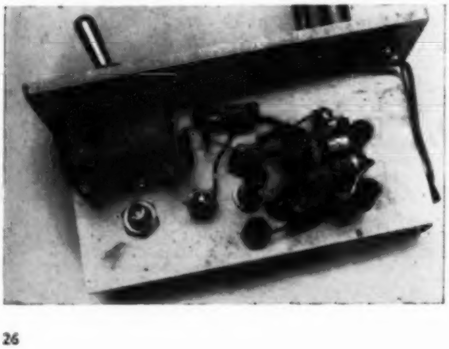
D_1—CK733 or DR 404
D_2—Hoffman in 1314 Zener
C_1—1-7 Piston Trimmer
C_2—Johnson 1-7 mmfd miniture variable
C_3—Disc
L_1—6T #20, ¼" dia, ⅜" long tapped 1T from cold end
L_2—2T #20 ¼" dia, at cold end of L_1
L_3—9T #20 ¼" dia close spaced

Placement of parts is not critical with the single exception that the oscillator and multiplier circuits are shielded from each other. Care should be taken to anchor all components securely and ground the crystal case. The schematic diagram is shown in Fig. 5.

Adjustment

After the oscillator circuit is wired completely check all connections before applying supply voltage. Make sure the correct battery polarity has been observed. Apply voltage and with the unit lightly coupled to a receiver on 54, 72 or 144 mc, depending on your choice of crystals, tune C1 for maximum output. When this point is found, turn the supply voltage off and then on again to see if the unit is still oscillating. If not, retune C1 slightly higher in frequency until the oscillator starts up instantly on application of supply voltage.

Next solder the multiplier diode from C2 to the center conductor of the 1296 mc trough line one inch from the end plate opposite from the side of the output pick up. Couple the output of the beacon to a 1296 mc receiver using maximum coupling to the line tank and with C2 set for approximately half capacity, adjust C3 carefully for maximum output and tighten the nylon nut. Next adjust C2 for maximum output. This adjustment will be quite broad and once set does not require additional setting. Now vary the coupling loop from the oscillator and readjust C1 for maximum output until you find the optimum coupling point. Place the shield can in place and bolt it down. You now have a completed beacon source.

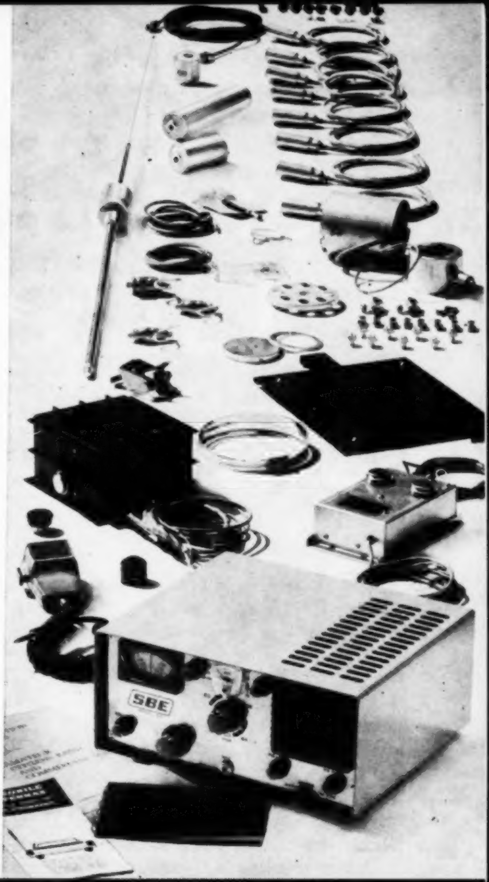


After many months of use here in the shack, it was found that ready access to C1 was desirable to make minor adjustments in the exact output frequency. To facilitate this a small hole was drilled in the case opposite the C1 tuning screw. A small snap-in hole plug was used to cover the hole when the adjustment was complete.

The unit here has been used for more than one year and a half on the same battery and is still going strong. It gets more than its fair share of work, particularly when tuning up 1296 antennas. It can often be seen on top of a step ladder in the back yard with a 1296 mc ground plane plugged directly in the output jack. . . . W6GGV

TONS OF AMATEUR EQUIPMENT IN STOCK
WESTERN RADIO
SAN DIEGO
1413 India Street BE 9-0361
MON - FRI 8:30 to 8:00 SAT 8:30 to 5:00

SBE VALUE "PACKAGES" for the mobileer



Two summer specials . . . **value "packages"** . . . each a complete, modern-to-the-minute mobile installation built around SB-33 **the** outstanding 4-band, SSB transceiver. Both packages offer important savings! Example, "Commuter": Here . . . **for only ten dollars more than the combined cost of SB-33 and SB-2DCP,*** you get antenna, antenna base mount, set mounting plate, microphone, noise suppression kit, coax cable, informative booklets, mobile log! Every item in each package is highest quality. Take advantage of these excellent "package" savings . . . **now.**

VACATIONER PACKAGE

$55.00 savings on the "Vacationer"
$605.00 value for only $549.00

The "Vacationer" package includes:
SB-33 Transceiver
SB-1MB Mounting plate
SB-2DCP Power inverter
SB-1MIC Controlled magnetic microphone
Band-Spanner Top-sider antenna including 80-40-20-15 meter coils
Band-Spanner H-215 mount
Webster, Electro-shield system including: coil shield, distributor shield, harness shield, spark plug shield and generator or alternator noise supression kit. (Full instructions)
21 feet, RG-58/U coax complete with plug
Booklet: "Mobile antennas, "Simple steps to peak performance"
Booklet: "Auto radio noise reduction techniques"
Mobile log book.

COMMUTER PACKAGE

$41.00 savings on the "Commuter"
$520.00 value for only $479.00

The "Commuter" package includes:
SB-33 Transceiver
SB-1MB Mounting plate
SB-1DCP Power inverter *
SB-1MIC Controlled magnetic microphone
Band-Spanner Top-sider antenna including one (1) coil for any band desired. (80-40-20-15)
Band-Spanner H-215 mount
Band-Spanner spark plug and generator suppression kit.
21 feet, RG-58/U coax complete with plug
Booklet: "Mobile antennas, "Simple steps to peak performance"
Booklet: "Auto radio noise reduction techniques"
Mobile log book.

* Now being shipped with SB-2DCP inverter.

SBE **SIDEBAND ENGINEERS**
317 Roebling Rd. So. San Francisco, Calif.

Export sales:
Raytheon Company, International Sales & Services,
Lexington 73, Massachusetts, U.S.A.

RAYTHEON

Please send full information on "Vacationer" and "Commuter"

NAME

NUMBER STREET

CITY ZONE STATE

Leonard Geisler AES

Squelch for the Transistorized Receiver

Tired of that "snap-crackle-pop" when monitoring a net frequency? This jim-dandy garbage disposer will firmly squelch noise, open only for legitimate signals. It also saves battery power and nerve endings in the old ears!

Although intended for use in the author's Heathkit Mariner (RDF), it will work on any transistorized communications or entertainment receiver. It is featured also, in a handy-talkie designed by the author. Only a few inexpensive parts are called for, which are non-critical. The ambitious ham can build a spider-webbed test circuit in a relatively short time; the serious amateur can install a professional version in his set in a matter of an hour or less.

How It Works

None of the resistors or other parts of the set's driver transistor are changed, only the squelch transistor is added to control the power gain of the driver.

Normally, relays are used to cut off the set's speaker. In this circuit, we cut off the driver transistor, resulting in faster, noiseless and non-mechanical control. Three fixed resistors, two capacitors, an inexpensive diode and a low power audio transistor are all the parts called for. The 10 k ohm squelch adjust control may be replaced with a cheap switch and a fixed resistor, if desired.

The transistor is wired as a class B, or "plate" detector, in parallel with the set's normal diode detector. Without carrier, rectified noise is prevented from being amplified by the driver due to current flowing via D_2 to the emitter resistor of the driver transistor. This current flow raises the emitter much above the base bias, so the driver is cut off. The 10 k ohm squelch adjust resistor is set so that noise is not allowed to be heard, but a carrier, rectified by the base diode of the squelch det/amp will cause this transistor to conduct, changing the polarity—in effect—of the bias on D_2 which then loses its hold on the emitter of the driver and the driver promptly takes over, allowing us to hear the incoming signal. The 4.7 k ohm base-to-ground resistor prevents the squelch transistor from conducting on low levels of random noise. The resistor network in the same transistor's collector line serves to filter out detected AF and to distribute dc power between the squelch transistor and the driver's emitter resistor. No appreciable disadvantage results from the connection of the squelch transistor in parallel with the set's own detector. The squelch is out of circuit when the 10 k ohm resistor is run all the way to the stop away from B-.

Ref: Application data supplied by Amperex Electronic Corp., 230 Duffy Avenue, Hicksville, L. I., N. Y.

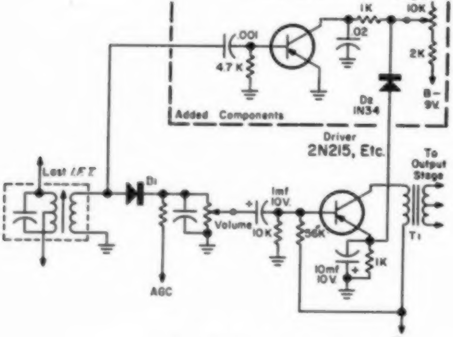


FIGURE 1

Those Fragile Transistors

Joseph Crowling K4CPR
1034 Falmouth St.
Warrenton, Va.

How many articles have you read that told you to handle transistors like they were made of fragile glass? I have met amateurs who were afraid to use transistors because of all the magazine articles that tell how easy it is to damage them. Don't believe it! Transistors are more rugged than any vacuum tube.

Many amateurs seem to be afraid that soldering a transistor into a circuit will ruin it. Let's pick a transistor and see what the manufacturer says. I have had a little experience with the 2N527, so let's use it as an example. The specification sheet says that you can raise the temperature of the leads (1/16 inch from the case), to a temperature of 500 ° F. for 10 seconds without damaging the transistor. I use 60-40 solder and it melts at about 380 ° F. My 35-watt soldering iron reaches a temperature of about 700 ° F. Anyone with a little experience does not need 10 seconds to make a good solder joint, and it is seldom necessary to solder within 1/16 inch of the case. Therefore, I believe that this transistor is no more easily damaged than a capacitor or resistor when soldering it into the circuit. Damage to a transistor caused by heat is usually in the form of a damaged seal (although, it is possible to ruin the solder connections inside) and is not detectable immediately after soldering the transistor into the circuit. The damage shows up as a shortened lifetime. This shortened lifetime is due to moisture and other impurities getting into the transistor and causing a gradual degradation of parameters (mainly increased I_{cbo} and lower beta). Just as in vacuum tubes, manufacturers of transistors use getters inside the cases to absorb residual gases that are inside at the time of sealing. For the preceding example, I "just happened" to pick a good transistor. Some are better and some are not. If you try soldering tubes into circuits you will find that heat damages tubes as well as transistors. If you are afraid of heat damage, use a transistor socket, they are cheap and reli-

good
mobiles
STILL
go go

HUSTLER

by NEW-TRONICS

the home of originals!

HUSTLER is the mobile antenna that has won the widest praise from everyone that has used it. For really reaching out, and for exceptional results on every band, the HUSTLER has no equal. For unbiased opinion of performance, ask any HUSTLER user . . . there are thousands of them.

See the HUSTLER at your dealer or write us for literature.

NEW-TRONICS CORPORATION
"the home of originals"
3455 Vega Ave., Cleveland, Ohio 44113

able. Every time a new semiconductor device comes out, we find that someone has thought up a new case or lead configuration to go along with it. This creates problems for the socket manufacturers. Standardization of transistor cases would probably lead to increased use of sockets and less heat damage problems. We amateurs need not worry about all these problems. We are not concerned with extreme reliability. With a little care anyone can solder transistors into a circuit without damaging them.

I have seen articles warning about damage to transistors due to static electricity and also damage to transistors from having their leads cut by cutters with V-shaped cutting edges. Well, the above are dangers for someone who is interested in extremely high reliability for military and space applications, but amateurs need not even consider these things.

It is hard to find a vacuum tube that is as rugged mechanically as a transistor. When a vacuum tube falls off my workbench and lands on the cement below, I reach for the broom; but I would be surprised if the fall damaged a transistor. Even though a fall like this would possibly create enough G's to damage a transistor, I have seldom seen it do so.

I have used hundreds of transistors and found them to be very rugged devices. I am not saying that they are indestructible (no component is idiot-proof), and heat sinking the leads while soldering them into a circuit is a good safety precaution; but don't let anyone tell you a transistor is fragile as antique china. If you will treat them with the same care as you do other components, you will not have trouble with them.

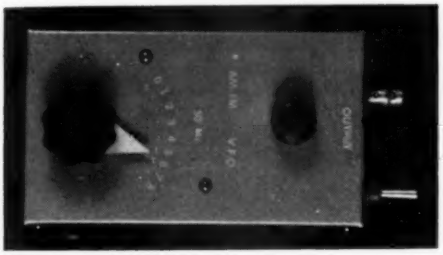
Just for the record, I do not work for a transistor manufacturer and I do not sell transistors for a living.

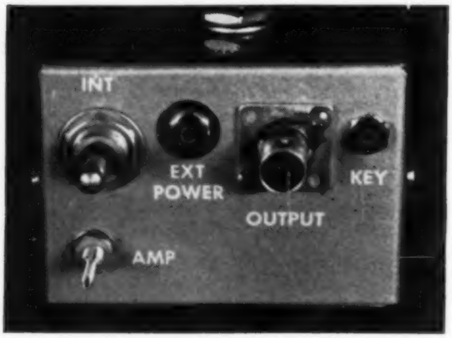
. . . K4CPR

Edward Pagel WA0HQA
1161 Xanthia St.
Denver, Colo. 80220

Photos by: John Taylor K7SMR

Transistor AM-FM VFO





Why not a cheap easy to build transistorized VFO? For some reason there seems to be a gap in the development of this type of ham gear. So, I decided to try it and it works even better than anticipated. The advantages are numerous. Since there is no tube to heat up the components, drift is almost non-existent as long as the voltage is stable. (This is accomplished with a Zener diode.) A bonus in the design is the ease with which it can be reactance modulated for NBFM. Excellent FM quality is obtained by merely coupling the output of a mike directly into the base of the oscillator. Frequency shift keying is accomplished by changing the bias slightly with a 100 K resistor to ground. (The shift is about 400 kc.) This FM VFO paves the way for a high powered economical transmitter since an expensive power hungry AM modulator is not required for phone operation. Any CW transmitter is instantly converted to phone with this compact oscillator. NBFM is not a disadvantage with AM receivers since any superhet receiver can copy FM very well by slope tuning slightly. When operated with external power which may be stolen from the receiver, the VFO is rock stable. An internal battery may be used, however, a slight drift may be

TRANSMITTER, RECEIVER AND POWER SUPPLY ALL IN ONE HANDY PACKAGE!

GONSET G-50 6 METER Fixed Station COMMUNICATOR

Here's another great GONSET concept in amateur radio communications: Model G-50 with 48 watt transmitter with VFO, ultra-sensitive dual conversion receiver and power supply in a "package" less than one cubic foot! Frequency coverage: 50-54 mcs. Simply connect antenna, microphone and 115 v. AC power and enjoy a new, exciting communications experience in 6-meter DX.

TRANSMITTER: Simple, uncomplicated in operation and adjustment • Husky 48 watt input transmitter uses Type 6146 tube, has pi network output • Modulated by a pair of 6L6GC's • Multiplier stages ganged and tracked with highly stable, calibrated VFO or optional crystal • VFO spotting switch facilitates "zeroing in" on desired stations • Panel meter switchable to read amplifier grid or plate currents or modulator plate current • Built-in low pass filter attenuates transmitter harmonics, spurious emissions above 65 mcs by 80 db or more.

RECEIVER: Contains RF stage for low-signal-to-noise ratio and ultra-high sensitivity • Dual conversion provides excellent image rejection and 7 kcs selectivity • Adjustable squelch • Super-sensitive noise limiter, "S" meter, panel mounted loudspeaker • Calibrated "Full-Vision" dial with planetary vernier for smooth, easy tuning.

POWER SUPPLY: Heavy duty 115 v. AC power supply.

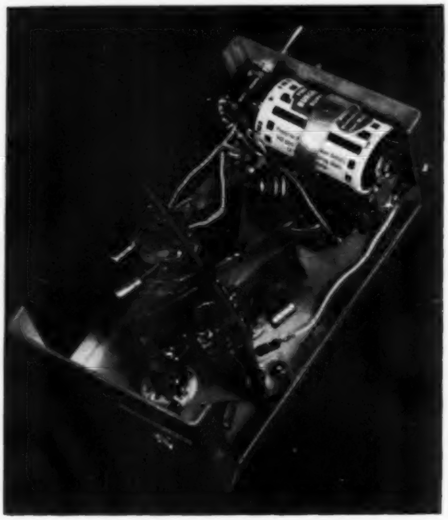
DIMENSIONS: 7½" h., 13" w., 12½" d.; wt. 29 lbs. Finished in attractive Light Gray.

PRICE: $367.30 Amateur Net; CD Model 3300: $389.95.

For complete information, visit your Gonset Distributor or write Dept. 73-8

GONSET, INC.
ALTEC LANSING CORPORATION
A Subsidiary of Ling-Temco-Vought, Inc.
1515 S. MANCHESTER AVENUE, ANAHEIM, CALIFORNIA

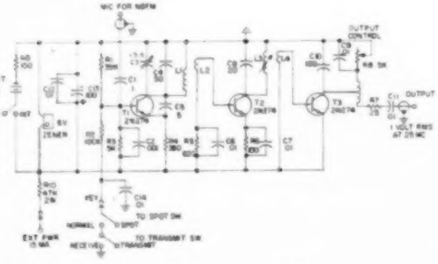
© ALC 1964



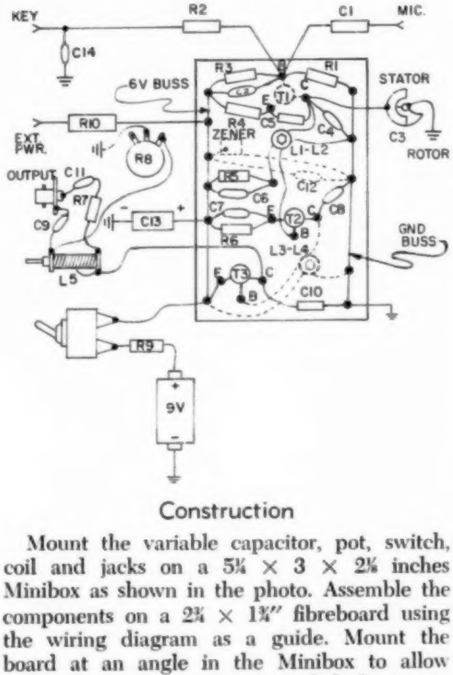
noticed over a period of time unless a mercury battery of adequate capacity is used.

Circuit Description

T1 is a grounded base oscillator which is very frequency sensitive to voltage variations at its base. By changing the resistance of R3 the amount of frequency deviation for NBFM can be adjusted to the particular microphone used. More resistance gives more deviation and vice-versa. When this VFO is used for AM the mike is unplugged from the VFO which then operates in the normal manner. T2 and T3 are conventional amplifiers which provide isolation as well. The output amplitude is controlled with a pot in the collector of T3. An autotransformer is employed in the final stage to increase the output impedance and voltage. If higher voltage is necessary to get enough drive for the transmitter, a coil consisting of 5 to 10 turns of solid insulated wire 3/8 inch in diameter, closewound, may be inserted in the transmitter between the VFO jack and the grid of the input tube. Internal power may be either a 6 or 9 volt battery. When a 6 volt battery is used, the series 100 ohm resistor is omitted. For hookup to external power, a dc supply of 50 volts or more which will handle an additional 15 ma is tapped in the receiver or converter. To determine what size dropping resistor is required, insert a milliamp meter in series with a pot of about 25 K and the VFO external power connection. Slowly decrease the resistance until the meter reads 15 ma. Measure the pot and substitute a 2 watt resistor of the same size. Be sure the internal battery switch is off when using external power.


MIC FOR NBFM
OUTPUT CONTROL
BATT 9V
EXT
6V ZENER
C1
C5
L1
L2
L4
C2
C6
C7
C10
C11
C14
T1 2N274
T2 2N274
T3 2N274
R8 5K
OUTPUT
1 VOLT RMS AT 25 MC
KEY
TO SPOT SW
NORMAL
SPOT
TO TRANSMIT SW
RECEIVE
TRANSMIT
EXT PWR 15 MA

C3, C4, C5, C8, C10 are mmfd
C13—100vf electrolytic 10-12v
6v Zener—1N429 or equiv.
L1—17T #26 wire ¼" slug form
L2—2T on cold end of L1
L3—same as L1
L4—3T on cold end of L3
L5—25T tapped at 15T


KEY
R2
C1
MIC.
C14
R3
R1
6V BUSS
C2
E
T1
B
C
STATOR
R10
R4
C5
C4
ZENER
EXT. PWR.
L1-L2
C3
ROTOR
R8
OUTPUT
C11
R5
C12
R7
C6
C7
C8
C9
C13
E
T2
C
B
R6
L3-L4
GND BUSS
L5
E
T3
C
B
C10
R9
9V

Construction

Mount the variable capacitor, pot, switch, coil and jacks on a 5¼ × 3 × 2¼ inches Minibox as shown in the photo. Assemble the components on a 2¾ × 1¾" fibreboard using the wiring diagram as a guide. Mount the board at an angle in the Minibox to allow easy access to the coils. Grounded sheet copper shields should be located between L1 and T2 on both sides of the board to isolate the oscillator from load changes at the output. Mount the battery at the end of the Minibox below the pot. Keep all leads well clear of the oscillator. Small rubber feet are cemented to the bottom cover.

JARO ELECTRONICS

THE SWITCH
IS ON TO

VHF
SIDEBAND

JARO ELECTRONICS IS FIRST ON SIX WITH A NEW SIDEBAND ADAPTOR THAT CAN BE DRIVEN WITH YOUR PRESENT 6 METER AM OR CW TRANSMITTER . . .

UP TO 200 WATTS PEAK OUTPUT

- HIGH LEVEL DOUBLE SIDEBAND WITH A PAIR OF 6146S
- MORE THAN 45 DB OF CARRIER SUPPRESSION
- ANY 6 METER TRANSMITTER DELIVERING AS LITTLE AS 3 WATTS CAN DRIVE UNIT TO FULL OUTPUT
- BUILT-IN AUDIO OSCILLATOR FOR EASY TUNE-UP
- UNIT IS COMPLETE EXCEPTING POWER SUPPLY (600-1200 VDC @ 200 MA; 250 VDC @ 50 MA; 6.3 VAC @ 3.5 AMPS.
- DIMENSIONS ARE: H 6½"; W 9½"; D 7¾'

$129.95

JARO ELECTRONICS
PO BOX 64175
LOS ANGELES 46, CALIF.

ORDER NOW OR WRITE FOR INFORMATION
DEALERS INQUIRIES INVITED

Tuneup Procedure

Set the variable capacitor at midrange. Using a receiver tuned to 25mc as an indicator, adjust L1 for response on the S-meter. Be careful not to tune to an image. Connect the output to an FSM and adjust L2 and L3 for maximum output. Use your receiver to calibrate a dial for the VFO by hetrodyning with stations of known frequency. The dial in the photo is calibrated in tenths of a megacycle, 50.0 to 50.8. By changing the tuning of L1, any portion of the 6 meter band may be covered. It should also work well as a fundamental oscillator in the 10 meter band.

. . . WA0HQA

SOLDES

Si certains numéros de 73 vous manquent, voici une excellente occasion de complèter votre collection. Pour 5 F au lieu de 8, nous vous enverrons 4 numéros à votre choix (postérieurs à février 61). Si vous désirez recevoir une année complète nous vous enverrons toute la série pour 13 F alors que le prix normal est de 20 F. (A la rigueur nous accepterons 14 F au lieu de 13 si vous êtes superstitieux!)

Pour vous faciliter les choses, vous pouvez virer la somme dûe à F2 BO.

J-P CATALA, CCP 9372-41, Paris.

GELEGENHEIT

Falls Ihnen einige Exemplare von 73 fehlen, bieten wir Ihnen die Gelegenheit, diese Lücke auszufüllen. Für 4 DM statt 6, 40 DM können Sie 4 Nummern Ihrer Wahl erhalten (ab Februar 1961). Ween Sie einen ganzen Jahrgang wünschen, können wir diesen für 10 DM anstelle 16 DM übersenden.

TV CAMERA

We have the lowest prices and complete stock of all components for making your own Ham TV or closed circuit TV camera plus exclusive VANGUARD printed circuits and incredibly low prices on F1.9 lens with focusing mounts. Complete ready-to-operate cameras also available at the lowest prices you'll ever find.

For more information, price list, and photos, send 10c coin or stamps.

VANGUARD ELECTRONICS LABS, Dept. H-8
190-48—99th Ave. Hollis, N. Y. 11423

HYE-QUE ANTENNA-FEEDLINE CONNECTOR

New 3-in-1 molded plastic-and-metal fitting provides: coax feeder connection, heavy copper leads to elements, antenna center support. Hye-Que I Connector fits standard PL259. Reinforced, weather protected, ultra-efficient. At your ham store, or $2.95 ppd. Companion insulators, 2 for 99c ppd. Includes complete instructions.

BUDWIG MFG. CO., P.O. Box 97, Ramona, Calif. 92065

NOW OPEN!
in DOVER, N.H.

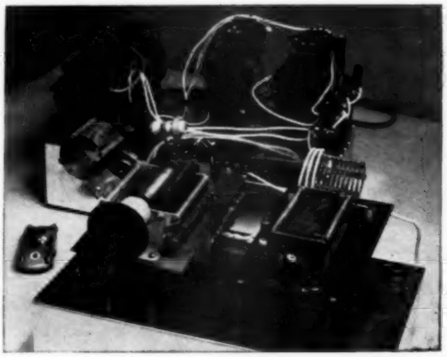
LAFAYETTE RADIO
ELECTRONICS

319 Central Ave. Phone: 603-742-3895

Open 10-6 daily; Tues. & Fri 'till 9;Sat 9-4

A Transistorized Final Amplifier for Forty Meters

Robert Schoening WØTKX
10040 Brookside Avenue
Minneapolis, Minn. 55431



Transistorized transmitters are usually either in the milliwatt class, or use vacuum tubes for the higher powered stages. Fairly high power transistor circuits have been developed even for VHF[1], and 5-watt citizens' band equipment is no longer a novelty; however the main advantages of transistors—size and power requirements—start to evaporate when the power level exceeds a few watts. If, after using transistors for years, someone suddenly invented the vacuum tube, it would be hailed as a remarkable improvement in rf power amplification.

Transistor rigs are undeniably fascinating, and make for interesting conversation. Best of all, they can be cheap! The power amplifier described here can equal the output of a 2E26 tube at 7 mc, and its total cost was under $5.00. To realize this sort of price, the surplus market must be combed for bargains. John Meshna's "85 watt 40 mc" advertisement in 73 yielded 2N1897 silicon NPN switches for $1.00 each. These will dissipate 85 watts, withstand peaks up to 80 volts, and handle average currents of an ampere or so up to about 25 mc. Some undoubtedly oscillate up to 40 mc, but their use above 7 mc is not likely to be very satisfactory. They are not intended to withstand all their maxima at once, nor under all conditions, so we must de-rate them somewhat for transmitting use. They were a great bargain. In addition to the 2N1897, Meshna, Poly-Paks, and perhaps others feature such goodies (from less than a buck to $1.98) as 2N389 units (40 watts dissipation and they should work on 80 and 160 meters); 2N1212 60 watters up to 3 or 10 mc, depending on whose book you consult; 2N1046 germanium PNP 40 watt 15 mc transistors. The supply is likely to persist, with numbers, ratings, and prices varying somewhat. At these prices, enough can be purchased to allow selection of better units for special applications.

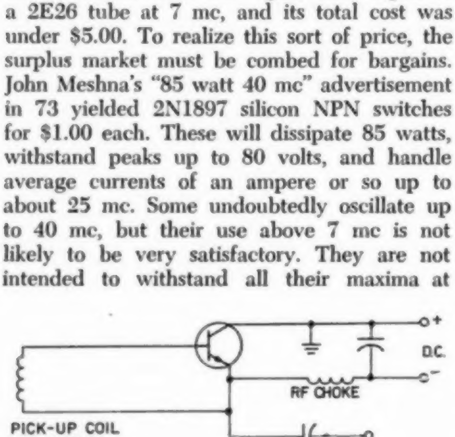

+
D.C.
−
RF CHOKE
PICK-UP COIL COUPLED TO EXCITER TANK
DC BLOCK'G C
TO LOAD CIRCUIT (PI,-T, TAPPED TANK,ETC.)

FIG. I

For the 2N1897 on the heat sink pictured, dissipation is usually limited to 10 or 15 watts. They run hot, but not alarmingly so, and one 2N1897 could probably handle all of the power that this rig has been called upon to deliver—perhaps 40 watts output. The design shown here is not the ultimate, but illustrates a stable and reasonably efficient application of these units as a basis, we hope, for further experimentation. Other similar transistors rated at 40 watts or more will operate within

Professional Performance

FOR AMATEURS WITH *Master Mobile* MOBILE EQUIPMENT

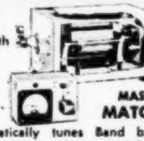
Deluxe
Ultra High "Q"
COILS

Designed for higher "Q" . . . with power units and SSB. Use with 3 ft base section and 60" whip. 15 or 20 meter, 6.95; 40 meter, 8.95; 75 meter, 9.95; 160 meter, 14.95

NO. 750
MASTER DELUXE ALL-BANDER

Covers 10 thru 75 frequencies. Silver-plated single turn contact, positive spring. Eccentric cam contact, easy selection of turn. Automatic lock prevents damage to coil.

14.95 NET



with
Field
Strength
Meter

MASTER
MATCHER

Automatically tunes Band by remote control. Motor driven variable inductance. All guesswork eliminated.

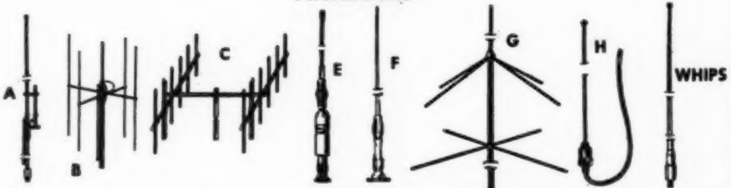
For 6V Mod. 2495- 6
For 12V Mod. 2495-12 24.95 Complete

No. 925
MICRO-Z-MATCH

Micrometer Impedance - Matching Inductance - Used on all bands with any type coax. cable to match any mobile antenna. Easily adjustable for minimum standing wave ratio (1:1). Complete with Coax. Adp. Kit

9.95 NET

ANTENNAS



A	AM-28 2-meter "J" mobile-fixed antenna provides 2 db gain. 86" hght.	14.95
B	AM-25 all aluminum "cloverleaf" factory pre-tuned 144-148 mc provides 3 db gain.	12.95
C	AM-5 twin six 2-meter beam with 12 db forward gain. Pre-tuned, aluminum, heavy duty.	16.95
D	(Not Shown) AM-4 same as above except 6 element beam.	8.95
E	AM-7 Sentry "Shorty" 2 meter 1½ wave top loaded fiberglass antenna with mount for CB use.	16.75
F	AM-10 "Shorty" as above except it's 6 meter shortened ¼ wave with mount.	10.95
G	Model 300 ground plane antenne outperforms any type verticle dipole. Ideal for CD and defense nets.	12.95
H	No. 613 Master VHF rooftop antenna for 140-165 Mc. Comes with 10' coax. cable.	4.95

WHIPS All with Threaded ⅜" stud to fit all mounts. 100-60S 60" 4.95; 100-72S 72" 4.95; 100-78S 5.00; 100-86S 86" 5.15; 100-90S 90" 5.20; 100-96S 96" 5.25; 100-103S 103" 6.95.

FIBERGLASS WHIPS — Flexible, indestructible universal antenna with ⅜" x 24 thread base fitting chrome plated. FG-60 60" 4.95; FG-72 72" 4.95; FG-84 84" 5.15; FG-96 96" 5.25; FG-103 103" 6.95.

E-Z OFF ANTENNA CONNECTOR

Noise-free. Connect or remove loading coils, whips, or mounts without tools. No. E-Z 295.

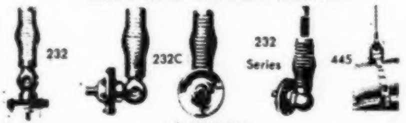
2.95 NET

No. 10-H

TENNAHOLD
Fits All Cars

1.00 NET

BODY AND BUMPER MOUNTS



BASE MOUNT	DESCRIPTION	NET
232	D'ble Tapered Spring—Swivel Base	8.75
232C	D'ble Tapered Spring—Swivel Base Coax. Conn.	8.75
232SS	D'ble Tapered Spring—Spec. Stainless	12.95
232SSC	D'ble Tapered Spring—Spec. Stainless — Coax. Conn.	12.95
232X	Heavy Duty—D'ble Tapered Spring—Swivel Base	9.85
232XC	Heavy Duty—D'ble Tapered Spring—Coax. Conn.	9.85
232XSSC	Heavy Duty—D'ble Tapered Spring—Spec. Stainless — Coax. Conn.	14.95
232XSS	Heavy Duty—D'ble Tapered Spring—Spec. Stainless	14.95
232XX	Extra Heavy Duty Spring	10.85
232XXC	Extra Heavy Duty Spring—D'ble Tapered—Coax. Conn.	10.85
232XXSS	Extra Heavy Duty Spring—D'ble Tapered—Spec. Stainless	15.95
232XXSSC	Extra Heavy Duty Spring—D'ble Tapered—Spec. Stainless—Coax. Conn.	15.95
445	Universal Mount—Threaded, ⅜"-24—Chain Mount	7.95

GUTTER MOUNT CG-275

Eliminates hole drilling. Positive locking, retractable and adaptable for any ⅜" 24 thread whip.

7.95 NET

UNIVERSAL MOUNT

TM-1 is Chrome plated alloy steel mount for any antenna with ⅜" 24 thread.

4.45 NET

FOR TRUNK LID, COWL MOUNTING

MMM-75 is adjustable for any curved surface. Equipped with coaxial connector.

7.95 NET

BUMPER MOUNT

MM-520 with shaped links adjustable to any width surface. For spring or whip double mount.

Pat. No. 3,100,241 7.95 NET

MM-519 S'gle Mt. 4.95

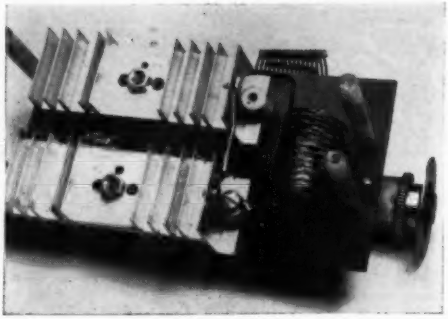
Buy Master Mobile from ALL Leading Dealers
SEND FOR FREE "ANTENNA BUYERS' GUIDE"

Master Mobile Mounts

DIV. OF ELECTRONICS WHITEHALL CORPORATION

4125 W. Jefferson Blvd. Dept. 73-56
AREA 213, 731-2251

LOS ANGELES, CALIF.
TWX 213-737-1315



their frequency limitations in similar circuits.

Most VHF designs, because of the embarrassing heat-sink-to-chassis capacitance, use grounded collector circuitry with the "bootstrap" excitation circuit to avoid degeneration. This circuit is shown in Fig. 1. In some rigs several transistors are simply connected in parallel to get more output, while others use sophisticated "parallel-pi" or "lattice-network" balancing arrangements to distribute the work evenly.[2] DC tests in the Hickock 850 transistor analyzer indicate that while straight parallel connection may be satisfactory for rf, it has limitations; so the design here includes separate base resistors—their function somewhat analogous to the small equalizing resistors used when gas diodes are paralleled. The one-ohm emitter potentiometer happened to be on hand (from a surplus assortment) and was included for balancing the currents; however it balances at dead center, so it could be replaced by two ½-ohm resistors (or just omitted, probably). By-passing such a low resistance with non-inductive capacitors is quite hopeless, and the two .2 mfd mylars are really just a gesture. Series resonating the excitation circuit (pick-up coil, base-emitter junction) would probably reduce the drive requirements. The primary objective, however, of this design was the development of a simple, efficient output circuit. Fig. 2 shows the final result with the T-network low-pass antenna coupling system.

At 7 mc, with the necessarily very low load impedances encountered, there is no reason to put the load in the emitter lead as in Fig. 1. On the other hand, there is no reason not to, and this may simplify insulation in some layouts. The coils can be computed close enough for fudging with the variable capacitor at 40 meters, and they can be squeezed in VHF applications, so that the T-network has the advantage over the PI of having only one adjustment. The old standby parallel tuned circuit with the collector tapped very near the bottom requires either a capacitor with an ungrounded rotor, or an inconveniently adjusted tap on the coil. In the T, quite reasonable values of capacitance are used—even on the lower H-F bands—unlike the other circuits. The function of all of these output circuits is to take the 50 or 75 ohm impedance of the antenna's coaxial feedline, and step it down to present some ridiculously low resistive load to the transistors' collectors. RF currents can be quite high, and coils of good design are essential.

Without going into the mathematics involved (the charts neatly sidestep that), the T-network's output antenna resistance and coil, L2, have the same effect as an inductor and a much larger resistance in parallel with the capacitor, C. The capacitor is more effective than the inductor in this combination, so it appears as a smaller resistance again, in series with a capacitor. The input coil L1 cancels the capacitance, and presents this smaller resistance to the generator as a load. An energy storage to dissipation ratio ("operating Q") of 12 or so, as is quite commonly used in parallel tuned tanks, offers excellent harmonic suppression. The T-network shown is basically a low-pass filter, and while we realize good harmonic attenuation, its use in a multiplier stage (or even driven by a multiplier) might require precautions to prevent the fundamental frequency from feeding through to the antenna.

The layout shown has the 2N1897 collectors tied directly to their heat sinks which are mounted on the insulated side of copper-laminated fiber board—insulated from the mounting screws. The input coil of the T-section, L1, is wound of number 10 wire and mounted on the opposite side of the board from C and L2 to avoid inductive coupling.

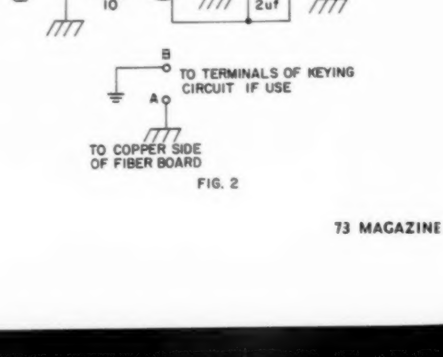


FIG. 2

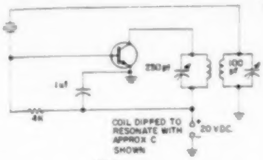


FIG 3

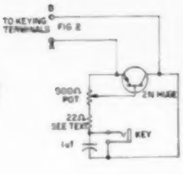


FIG 4

The rf choke is not called upon to do much, so that anything capable of carrying the rather high current involved will work. A layer of #26 wire close-wound on a ¼" dowel worked fine (about 3 or 4 inches winding length) until the single pie surplus choke in the picture was located in the junk box—it takes up less room. The dc blocking capacitor was placed between C and L2 where the current is much lower than at the collectors; this permits the use of a disc ceramic, although a good mica capacitor is generaly better where high currents must flow. The amplifier and its accompanying crystal oscillator stage were mounted on the blank chassis with plastic pillars—mostly to avoid cutting holes in the chassis, which will undoubtedly find other uses in the future.

A two-tuned-circuit oscillator, as shown in Fig. 3, delivers more output than the one pictured. In any case a lot of feedback is required—use husky crystals. A smaller oscillator stage and a 2N1897 buffer are planned for the amplifier, or even a VFO, which would require several additional stages, since the internal heat developed in large transistors would wreck the stability.

The transmitter was intended to operate at 20 to 24 volts dc supply voltage, although voltages up to 40 volts have been used with no failures. The source of 12, 24, and 40 volts filtered dc at several amperes is no problem at all on the surplus market. The supply shown uses a two-output bridge with tapped transformers for further flexibility. It supplies 6 amperes, has 24000 mfd of filter capacitance and a 3 ampere choke in each output's filter. It cost less than $15.00 for parts—mostly from Meshna's catalog. Perfectly adequate dc sources can be built for considerably less.

New modulation circuits for transistorized rigs[3] have been designed integrally with the rf circuitry. Their designer is apparently unfamiliar with normal amplitude modulation criteria, and is certainly unfamiliar with the proper terminology used around transmitters, but he offers excellent solutions to the problem of modulating battery-operated CB equipment. With this higher-powered HF rig, tests indi-

SPECIFY SAXTON

For Antenna Wire

Copperweld #6-#18
Solid Copper #12-#14
Stranded Copper 7x22 - 7x26

For Guy Wire

Galvanized Steel 4x20 - 7x18 - 12x20
Aircraft temper aluminum 7x18
Copperweld 6x20 - 8x18
Tiller Cable 3/32"

For Feeder Wire

Twin Lead
Open Wire
Coax
Open Twin Lead

Ground Wire

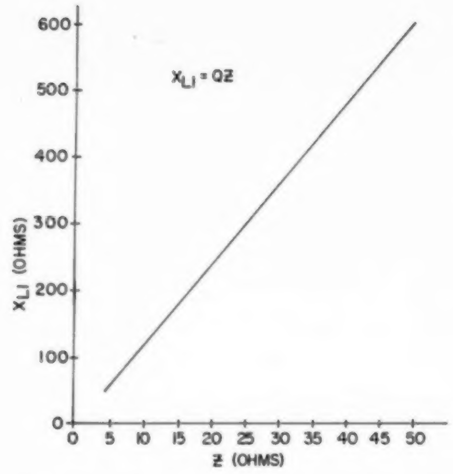
Solid dead soft aluminum #6 - #8

Rotor Cable - Mike Cable - High Voltage Wire. Plus dozens more types of wire and cable . . . AND MIL SPEC WIRE AND CABLE WITH CERTIFICATION.

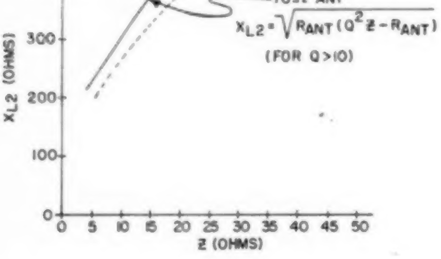
Send for our catalog

Saxton Wire and Cable

4121 Park Avenue
Bronx 57, New York



cate that ordinary collector modulation will achieve good linearity up to 60 or 70 per cent—about all that normal speech averages anyhow. This requires that the dc supply voltage be kept around 20 volts, a value that should always be used for tuning and testing before higher voltages are applied. For use as a linear amplifier, modulating the preceding stage, good operation can be obtained using about 40 volts dc if the output is properly loaded. A combination of collector modulation and some modulation applied to the preceding stage will undoubtedly allow higher modulation capabilities. The only attempt at modulation actually tried on the air was simply plugging a carbon microphone into the key jack, using the keying transistor circuit of Fig. 4. Turning down the base current below saturation, this allowed readable 'phone transmission, but was not analyzed for distortion or modulation percentage. Any attempt to combine the keying and modulation circuits could include an increase in supply voltage when the keying transistor is not saturated, since it is basically a series modulation system. Several surplus transistors were tried in the keying circuit, and finally one (unmarked) was found that worked. It should be a big brute such as a 2N174 or 2N1970, but don't buy a new one until you try what you have. Adjust the potentiometer toward the collector end until the collector current stops increasing, and if it is not saturated at the bitter end, use a higher-gain transistor or a smaller resistor in place of the 22 ohms which is to limit base current to a safe level. This circuit keys both stages, and no filtering is required when the oscillator and amplifier are keyed together.



The most unusual part of this amplifier's design is its tank circuit which may be employed wherever similar impedance transformations are required. The curves, Fig. 5, require a bit of computation, but no higher mathematics. If you don't feel up to it, any neighbor ham of high-school age will get a kick out of exhibiting his algebraic facility, and will solve the problems for you. A high degree of accuracy is not essential; slide-rule answers are just fine. Follow the step-by-step instructions (referring to the example) as if you were wiring a kit. Here they are:

1. Determine the desired load impedance, Z, from $Z = \frac{E^2}{2P}$; where E is the dc supply voltage, and P is the anticipated power output (let's keep it below 40 watts).
2. For this Z and the 50 or 70 ohm antenna you intend to use, find the reactance values for L1, C, and L2 by referring to Fig. 5.
3. Find the capacitance to represent the proper reactance for C on the frequency band you intend to work—use a variable from the junk box that will tune through this value.
4. Find the required inductance values for the coils, L1 and L2 and wind them up out of suitable wire from the junk box (or borrowed from a friend). The reactance and inductance formulas are given in the following example.

If you are an old hand at ac theory, you can skip this paragraph, but here is how this particular circuit was designed. An output of 20 watts at 20 volts dc supply voltage was anticipated. The load impedance required should be about 10 ohms from step 1:

$$Z = E^2 \div 2P = 20^2 \div 2 \times 20$$
$$= 400 \div 40 = 10 \text{ ohms}$$

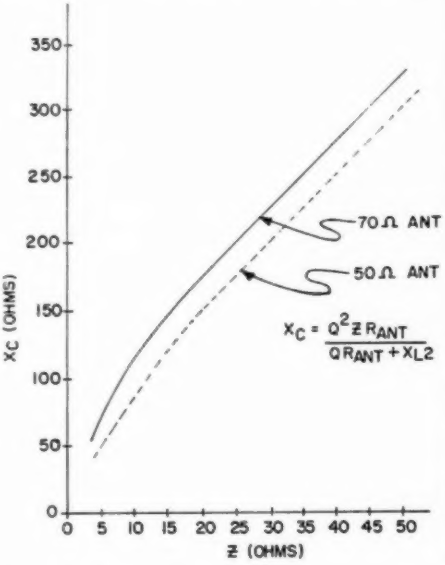
Consulting Fig. 5, and selecting values for a 50 ohm antenna yields these values: X_{L1}= 120 ohms; X_{L2}=260 ohms; X_C=83 ohms. The approximate formulas shown on the curves could also have been used, not because any additional accuracy is necessary, but because other values of q, Z, or R_{ant} might be desired. The reactance formulas, with f=the frequency in megacycles, are

$$L_{\mu h} = \frac{.159X_L}{f} \ \& \ C_{pf.} = \frac{159000}{fX_c}$$

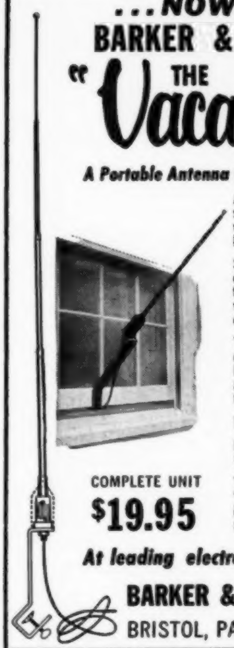
which give L1=2.7μh., L2=5.9 μh., and C= 275pf. To find the number of turns on the coils, after choosing a convenient radius and winding length (radius=r inches, length=b inches), try

$$N = \frac{1}{r}\sqrt{L_{\mu h}\,(9r + 10b)}$$

L1 as shown was about 1½ inches long, ½ inch radius, requiring 14 to 15 turns. L2 is ¾ inch radius and 1¼ inches long, and also required about 14 turns. L1 carries much heavier current, so it was wound of #10 wire, while #18 was adequate for L2. In



. . . NOW FROM
BARKER & WILLIAMSON
"THE Vacationer"
A Portable Antenna for 2 through 20 Meters!



A lightweight, compact telescopic whip . . . mounts anywhere: motel, cottage, trailer, hotel, boat.

Supplied with interchangeable coils and shorting bar for 2 through 20 meters. Furnished with mounting bracket, base and coaxial line (less connector).

The telescopic whip is heavy-duty and chrome plated, the base is high impact polystyrene, a weather-proof boot protects the loading coil.

Low SWR on all bands.

Retracts to 18½ inches, fits into KWM2 carrying case.

COMPLETE UNIT
$19.95

The Vacationer is ideal for the "ham" who travels—it can be installed and disassembled in minutes.

Pat. Pending

At leading electronic distributors

BARKER & WILLIAMSON, Inc.
BRISTOL, PA. / Phone 215-788-5581

SATURN 6
the original
HALO

Saturn 6 Antenna only $11.95
Saturn 6 plus mast & bumper mount $16.95

AT YOUR DISTRIBUTORS OR WRITE DIRECT

Products Co.
HI-PAR
FITCHBURG, MASSACHUSETTS

spite of the approximations and the shortcomings of formulas purported to apply to small air-core coils, these values are quite satisfactory.

With no excitation applied to this type of amplifier, it simply draws no current, so there is no need to key it if the oscillator keys well alone, or if any existing keyed exciter is utilized. About the only precautions which must be observed in tuning are to keep the base-emitter circuit complete (do not open the excitation pick-up coil with dc applied to the collectors), and to keep the collector voltage down until tuning, testing, and experimenting are finished. Don't expect a neon bulb to light, except perhaps on the capacitor stator, as there are no real high-voltage points. Tune for maximum current. If you can touch the transistor with your finger without smelling meat burning, it is probably not too hot. In cases of extreme mis-match, it would be well to check for harmonic output before operating, but the T-network is really quite tolerant of small varitions in impedances as the curves show. For full output use plenty of excitation—remember that some of this will find its way to the antenna, unlike a vacuum tube amplifier where the drive simply heats the grid.

A rig like this will work as well as any conventional transmitter of equal power on the same band, and delivers enough output to work around the world. In spite of the disadvantages, putting your rf power transistors to work has these good points: it's easy, it's fun, you're bound to learn something, and it's CHEAP!

1. Boelke, Dolby, & Moss, "An Experimental 20 Watt 160 Mc. Transistorized CW Transmitter," "Solid State Design," June 1962.
2. W. A. Rheinfelder, "Transistorized Transmitter Output Circuits," "Electronic Equipment Engineering," October 1963.
3. W. A. Rheinfelder, "Modulation Techniques for Transistorized AM Transmitters," "Electronic Equipment Engineering," July 1963; and "Modulation Circuits for Solid State CB Transmitters," "Electronics World," Feb. 1964.

Minute Kilowatt Power Supply

Louis Adler K8IKA
2822 11th Street
Cuyahoga Falls, Ohio

Sounds ridiculous doesn't it? I thought the very same thing. Recently I've seen a number of kilowatt supplies in the three popular ham magazines. But in every one I noticed they're still using a transformer of large dimensions.

A friend of mine, K8UYZ, recently sent me a schematic of a silicon power supply. So while I was on vacation a month ago I decided to build this up, with the intentions of incorporating this in my linear amplifier.

I built this linear from an article in 73 about 9 months ago, using four 811A's in grounded grid. For the power supply I used 2 1400 volt transformers in series and a pair of 3B28's for rectifiers. After rectification and filtering I only had 1100 volts to the finals. This is one of the reasons for trying the new power supply.

The power supply has been revised to bring it down to the barest minimum of parts. You can actually build this power supply in a cabinet the size of a cigar box. I'm leading up to the basic difference shortly.

The first day of my vacation I went down to a local electronics parts store to dicker on the parts for this power supply. I had some used parts I could have used in this experiment but felt I would be much better off using new parts throughout. Of course the 16 silicons cost a pretty penny, but when I told the man I'd need six electrolytics, 100mfd at 450v, six bleeder resistors, and 16 .01 disc condensers, he gave me a real good deal on the silicons. The bill on all of the parts minus the transformer came to a little over thirty dollars. I came home with the new parts and started to work.

Construction

I mounted 3 electrolytics and 3 bleeder resistors on a piece of ¼ inch plexiglass. The size of this plexiglass was 3 inches by 5 inches long. I drilled four holes on each end and mounted ground lugs to attach the electrolytics with a bleeder resistor mounted across each electrolytic. It makes a neat little pack-

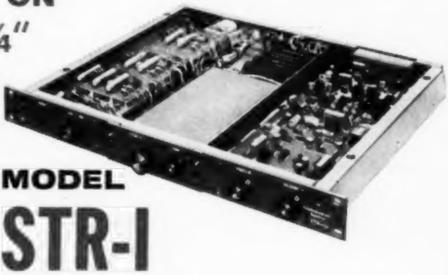
TRANSMIT/RECEIVE
SOLID STATE

LSB • USB • AME • CW • AFSK • AFAX

2—32 mc

ALL ON
1¾″

MODEL
STE-I
SPECIFICATIONS



MODEL
STR-I
SPECIFICATIONS

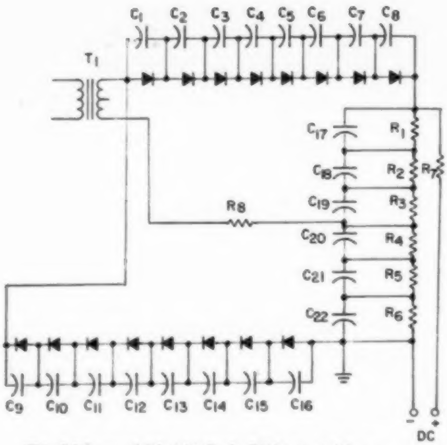
- **FREQUENCY CONTROL:** Crystals (oven controlled) in plug-in RF heads for 2-4, 4-8, 8-16 and 16-32 mc coverage. (Specify frequency when ordering.)

- PUSH-TO-TALK • VOX and anti-VOX
- 250 MILLIWATT RF OUTPUT into 50 ohms.
- OUTPUT IMPEDANCE: Nominal 50 ohms unbalanced.
- UNWANTED SIDEBAND REJECTION: At least 60 db below full PEP output.
- SPURIOUS & HARMONIC OUTPUT: 50 db minimum below full PEP output.
- CARRIER INSERTION: Automatic compensation for carrier to side-band ratio is accomplished by the mode selector switch.
- AUDIO RESPONSE: Nominal 3 kc.
- AUDIO INPUT: 600 ohm line, carbon mike, hi and lo Z mike.

- INPUT IMPEDANCE: Nominal 50 ohms unbalanced.
- SENSITIVITY: **1 microvolt for 15 db.** $\frac{S+N}{N}$
- SQUELCH: Threshold adjustable squelch. AGC activated relay has contacts brought to rear panel for remote indication of receiver signal activity.
- AF OUTPUT: 0 dbm to 600 ohms.
  500 mw into 4 ohms.
- SPEECH CLARIFIER: Manually controlled front panel.
- MONITORING: By means of front panel phone jack.

- **SIZE AND WEIGHT:** 1¾″ x 19″ x 15″. 10 lbs.
- **POWER:** 115v, 60 cps, single phase, 3 watts.

THE TECHNICAL MATERIEL CORPORATION
MAMARONECK, NEW YORK
and Subsidiaries
OTTAWA, CANADA • ALEXANDRIA, VIRGINIA • GARLAND, TEXAS • OXNARD, CALIFORNIA
SAN LUIS OBISPO, CALIFORNIA • LUZERN, SWITZERLAND • POMPANO BEACH, FLORIDA



T1 800 to 850 VAC 0 350 to 500 mr.—
C1 thru C16 .01 disc ceramic 600 V.—
C17 thru C22 100 mfd electrolytic @ 450 V.—
R1 thru R6 25K. wire wound 25 watt.—
R7 5 ohm 10 watt.—
R8 10 ohm 10 watt.—
16 Silicons 750 ma—600 PIV Mallory 1N3195
Output 1700 to 1800 VDC.—
Do not use a choke.
Do not use center tap.

age. Of course the electrolytics are hooked up in series, so you'll have two electrolytics on one side of the plexiglass and one on the other. Drill two holes on one long side and mount a right angle bracket in each hole and you have a way to attach this unit to the chassis. I made two of these units up and mounted them on an old chassis I had lying around.

Now I mounted the silicons and .01 condensors on a piece of surplus terminal board which happened to have 16 pairs of terminals. In mounting these units to the chassis make sure you have plenty of clearance between the components and the chassis so there is no chance of arcing.

Now comes the apex of the article. The schematic called for a transformer with the rating of 800 to 850 volts across the secondary and rated at 350 to 500 ma. Well, in searching through my stock of transformers, the only thing I could find was a TV transformer which had 900 volts across the secondary and how many mils it was good for was anybody's guess. There were no numbers or other identifying marks to search out any information on this transformer. But I'll say this, it is of the average size and not one of the rare large ones. By the size of this transformer I surmised that most TV transformers are rated at 250 ma and this one was in this category.

I figured the worst that could happen was that the transformer would burn out and then I'd have to look for another. I went into the linear and disabled the original power supply. Remember I said I built the new power supply on an old chassis, so I used jumper wires to the linear and double checked all of my hookups. One thing I might point out is to make sure not to overfuse the primary of the transformer. In my case I used a 5 amp fuse in each leg of the primary.

Well the big moment had arrived. I threw on the filaments on the linear and hooked a 500 watt bulb to the final for a dummy load. I turned the power on the primary and checked with a multimeter and with no excitation on the linear I had 1800 volts. I turned on the exciter and fed a signal into the linear and loaded up the linear for all she was worth. After about 3 minutes with a CW carrier I blew a 5 amp fuse. This I felt wouldn't bother me too much because I only operate CW and SSB. On checking the voltage to the finals with the key down, I found I had 1650 volts and the four 811A's were drawing 550 ma. This gave me a 907½ watt input signal.

Fine I thought, but how well was this transformer going to hold up? I attached a 75 meter antenna to the linear and loaded it up. The first evening I was on for 2½ hours and after that period of time the old TV transformer was hot enough so it wasn't comfortable to put the back of your hand to it.

This gave me an idea, I had overlooked the cut off bias on the 811A's. Of course I had it available in the exciter. The next day I attached this cut off bias to the finals so that when I was in the idle position at least there was no current draw against the transformer. This of course gave the TV transformer a rest once in a while. It also worked beautifully because the old transformer ran cool after being on the air for 3 hours.

The third day after testing this experiment I was still dubious as to whether or not she was going to hold up. I fired up first on 75 meters, then later moved to 20 meters. Eight and a half hours later I found the transformer was still luke warm. This proved it to me.

I tore the original power supply out of the linear the fourth day and using blank pieces of aluminum to cover the holes in the chassis, I built this new power supply into the linear. Of course, with this new power supply, I had a 1/3 gain over the original power supply.

It's been a month now since I've done this

DRAKE
R-4

The Ham-Band Receiver with the MOST!...

R-4
RECEIVER

**Model MS-4
Matching Speaker** $\$19^{95}$

Model R-4 Receiver
$\$379^{95}$
Amateur Net

Outstanding Plus-Features of R-4: Linear Permeability Tuned VFO. Will transceive with matching T-4 and T-4X transmitters. Improved overload and cross modulation performance. Built-in noise blanker. 10 accessory crystal positions for other frequencies in 1.5 to 30 Mc range.

Write for detailed literature.

R. L. DRAKE COMPANY • Miamisburg, Ohio

DRAKE
TR-3

The complete Sideband Transceiver with FULL BAND COVERAGE on both sidebands

**TR-3
ACCESSORIES**

REMOTE VFO Model RV-3	$79.95
MATCHING SPEAKER Model MS-3	$19.95
MOBILE MOUNTING KIT Model MMK-3	$6.95
POWER SUPPLIES	
AC Power Supply Model AC-3	$79.95
DC Power Supply Model DC-3	$129.95

**Model TR-3
Transceiver**
$\$550^{00}$
Amateur Net

SSB Transceiver, upper and lower sidebands on all Ham bands 10 thru 80 meters. AM and CW also. 300 watts P.E.P. on SSB, 260 watts CW. Linear Permeability Tuned VFO. Compact size, ideal for fixed or mobile use.

Write for FREE Brochure

R. L. DRAKE COMPANY • Miamisburg, Ohio

and do you know, that old TV transformer is still doing a terrific job. There's one thing I think most of us forget about a transformer. When they rate them they're rated for continuous use. So this, plus the cut off bias on the finals is the answer to this mystery. To prove a point, I just recently acquired a TV transformer of known ratings and fired it up on this power supply and got the same answer as the original transformer.

I've mentioned this on the air many times and everybody is astounded. I've been called a liar as well as being praised for this. So people, this is what prompted me to write this article.

The schematic for this power supply was drawn up by K9EVJ, and all my thanks to him for getting it up to Dave K8UYZ, a mutual friend of ours. If you doubt this story about the TV transformer just drop in on 3910 any evening and you'll hear this signal.

In closing, I can add this: the power supply was not designed for AM, but puts out a clear CW note. Also don't use any of the filament windings if you elect to use this type of transformer. The secret of being able to use a TV transformer for this power supply is the fact that it's only intermittently used. Dig out an old TV transformer and give it a whirl. You'll be surprised at the power in that little old hunk of iron.

. . . K8IKA

The Signal Helper

Thomas Skopal W3WJN
257 Strathmore Road
Havertown, Pennsylvania

Want to add some poop to your receiver at the expense of only half an hour's effort and two bucks worth of parts? You can, by adding an untuned transistor preselector between your antenna and Old Faithful's present input. Actually, this little circuit has two other advantages besides gain: By using the present receiver input tuned circuit as its load, gain is peaked at the tuned frequency, so rf selectivity is improved without adding any tuned circuits, and, on receivers deficient in this department, the signal-to-noise ratio can be improved. Since no major surgery is required, resale value of the equipment remains unaffected.

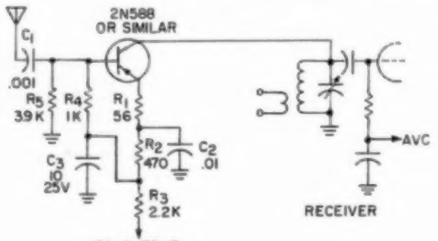


FIG. 1

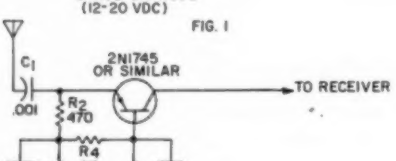


FIG. 2

Fig. 1 shows the common-emitter configuration, which works well up to and including six meters. The transistor's collector goes to ground through the secondary of the input transformer. If by chance your receiver has this connected to the AVC line instead of to ground, it is a simple matter to insert a blocking capacitor, apply the AVC after it, and then ground the transformer as per the diagram. Leave the primary disconnected. The grounded-base configuration of Fig. 2 is more suitable for 144 and 220 mc. Power can be obtained from the most convenient source of low voltage dc, the audio output stage's cathode. R_1 is very important; the degeneration introduced by this resistor helps quite considerably in minimizing cross modulation.[1] (The grounded-base configuration does not require this, since it is inherently less sensitive than the other.) After assembling, repeak the trimmer capacitors of the rf stage to compensate for the added shunt capacitance. Then listen.

This little gadget offers a lot of performance for the effort required to build it. You might find it a useful addition on all receiving equipment which leaves something to be desired, including mobile equipment, the XYL's AM broadcast radio (keep her happy!), and your FM tuner.

. . . W3WJN

REFERENCE

1. C. D. Simmons and J. Specialny, "Cross Modulation in Transistor Tuners" Philso Application Lab Report 775, October, 1962.

Burghardt RADIO SUPPLY Inc.

TRANSCEIVER HIT PARADE

DRAKE

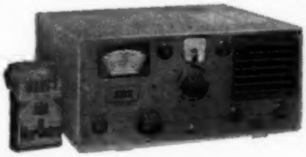
TR 3 Transceiver	550.00
AC 3 AC Supply	79.85
MS 3 Speaker	19.95
DC 3 DC Supply	129.95
Mk III	6.95

COLLINS

KWM 2 Transceiver	1150.00
516 F2 AC Supply	115.00
MP 1 DC Supply	198.00
351 D2 Mobile Mount	120.00

HALLICRAFTERS

SR160 Transceiver	349.50
P150 AC Supply/speaker	99.50
P150 DC Supply	109.50
MR 160 Mobile Mount	14.50



SBE

SBE-33 Transceiver	389.50
SB 2-DCP DC Inverter	79.50
SB-1 Mobile Mount	12.50
SB-1 LA Linear	279.50

SWAN

Swan 400 Transcievers	375.00
Swan 406 VFO	65.00
Swan 420 VFO	120.00
Swan 1117B AC Supply	75.00
Swan 512 DC Supply	145.00

NATIONAL

NCX 3 Transceiver	369.00
NCX-A AC Supply/speaker	110.00
NCX-D DC Supply	119.50

Write for our Special Transceiver Packet

HERES THE ANSWER!

If you want realistic pricing on top quality, fully reconditioned and fully guaranteed equipment—our answer is yes! These prices are "Go" prices on gear that is ready to "Go." Look em over real closely for there are some real "sleepers" in this month's listing.

73 Stan Burghardt WØBJV

	CASH/NO TRADE
AMECO Type CN Nuvistor 2 meter converter and power supply 28-32 IF	$ 39.00
CENTRAL ELECTRONICS 600L Linear	149.00
CLEGG ZEUS Transmitter with supply (like new)	309.00
COLLINS 32V3 Transmitter	195.00
COLLINS 75S3 Receiver (late serial number—like new)	475.00
COLLINS 75A-4 Receiver (serial number 786) with matching spkr.	375.00
COLLINS 75S-3 Receiver (excellent condition)	449.00
DRAKE 2B with Calibrator & Speaker	229.00
GLOBE CHIEF 90 Transmitter	29.00
GLOBE CHIEF 90A Transmitter	34.00
GLOBE 755A VFO Receiver	29.00
GONSET GSB-100 SSB Exciter	199.00
GONSET G-66 and 3 way Supply	69.00
GONSET G-66B and 3 way Supply	79.00
HALLICRAFTERS HT-32A AM/CW/SSB Transmitter	319.00
HALLICRAFTERS HT-37 AM/CW/SSB Transmitter	279.00
HALLICRAFTERS S38E Receiver	24.00
HALLICRAFTERS SX-101-3A	179.00
HALLICRAFTERS SX-111 Receiver	149.00
HALLICRAFTERS CB-5 Transistorized Citizens Band Transceiver	109.00
HALLICRAFTERS SX-140 Receiver	69.00
HALLICRAFTERS S119 Receiver	29.00
HAMMARLUND HQ-100 Receiver	99.00
HAMMARLUND HQ-110 Receiver	119.00
HARVEY WELLS R9 Receiver	49.00
HARVEY WELLS TBS 50D Transmitter with matching AC Pwr Supply	49.00
HEATH TX-1 Apache Transmitter	169.00
HEATH KIT UT-1 AC Power Supply	19.00
HEATH KIT MT-1 Cheyenne Transmitter	49.00
HEATH VF-1 VFO	15.00
HEATH KIT HP-10 DC Power Supply	24.00
HEATH HG-10 VFO	29.00
HEATH KIT HP-13 Transistorized DC Supply	49.00
HEATH HW-32 20 Meter Transceiver	119.00
HEATH DX-35 Transmitter	35.00
HEATH DX-60 Transmitter	50.00
JOHNSON VALIANT	179.00
JOHNSON VALIANT II Factory Wired (like new)	319.00
JOHNSON Standard 275 watt match box	39.00
JOHNSON PACEMAKER	159.00
KNIGHT HE40 Receiver	35.00
KNIGHT R100 Receiver and Speaker	159.00
NATIONAL NC-300 Receiver with Speaker	179.00
SBE-1 LA Linear (like new)	199.00
SBE-33 Transceiver—Late Model	299.00
SWAN SW-140 Transceiver	119.00
TECRAFT MODEL CC50 6 meter converter 14 to 18 mc IF	22.00

BRAND New Hallicrafters HA2 or HA6 Transverter complete with P-26 ac supply regular 449.00 Value—Special Only 199.00. Limited Supply

WRITE FOR LATEST REVISED BULLETIN
ISSUED MONTHLY

AMERICA'S MOST RELIABLE DEALER

BOX 37A

Burghardt RADIO SUPPLY Inc.

PHONE 886 5749

WATERTOWN, SOUTH DAKOTA

Richard Morgan
Applications Engineer
Texas Instrument Inc.
Dallas, Texas

High Performance Transistorized Communications Receiver

This article will describe a transistorized communications receiver designed to cover the amateur radio frequencies from 3.5 to 30 mc. A complete performance analysis of several of the top line vacuum tube receivers was made for the purpose of determining the present state of the art of vacuum tube communications receivers designed for this service. As a result of this study, it was decided that at least a double or triple conversion receiver with variable selectivity in the *if* strip capable of AM and SSB-CW reception was required. This receiver, therefore, was designed to compete, from a performance standpoint, with today's high quality vacuum tube receivers. It operates from either 115 volts ac or 12 volts dc, making it useful not only as a fixed station receiver but also as a portable or mobile receiver.

Circuit

A block diagram of the receiver is shown in Fig. 1. It is basically a triple conversion superheterodyne receiver employing a tuned rf stage and variable selectivity in the last *if* stages. The three intermediate frequencies are 2.2 mc, 455 kc, and 85 kc. The receiver operates from either 115 vac or 12 vdc power sources, and covers the amateur radio frequencies from 3.5 mc to 30 mc in five bands.

The incoming signal is amplified in the rf stage and converted in the first mixer to the first *if* of 2.2 mc. A single stage of amplification at 2.2 mc is included after which the signal is fed to the second mixer and converted to 455 kc. The 455 kc signal is again converted in the following stage to 85 kc.

Variable selectivity is achieved in the 85 kc *if* amplifiers by a method explained later. The output of the 85 kc *if* strip is fed to either one of two detectors depending on whether AM or SSB, CW reception is desired. Following the detectors is a two stage audio amplifier which develops approximately two watts of audio power across a 3.2 ohm speaker impedance.

Each of the seven sections of this receiver as outlined on the block diagram in Fig. 1 will be covered individually in the description which follows, and where applicable, pertinent design considerations will be included.

A complete circuit of the receiver is included, along with the important performance characteristics. The receiver contains ninteen transistors and six diodes.

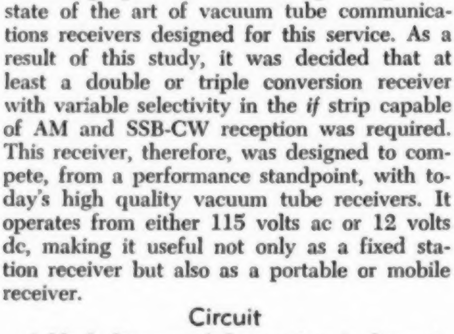


FIG.1

General

At the onset of the design of this receiver, it was decided that at least double and possibly triple conversion would be required. To achieve the desired selectivity and still maintain a small physical size for the overall receiver, it was decided that an *if* of 85 kc was desirable. The state of the art of high quality communications receivers dictated that a scheme of variable selectivity be included. The 85 kc *if* lends itself to a very reliable and fairly simple method of variable selectivity which contributed to the selection of this frequency for the *if* stages.

The choice of the first *if* frequency involved several considerations. It had to be lower than the lowest frequency, 3.5 mc, to which the front end is to be tuned. To prevent *if* pickup of broadcast stations, it had to be higher than the standard broadcast band, 540-1610 kc. These two factors limited the range of the *if* to between 1.7 and 3.5 mc. The first *if* frequency also had to be high enough to produce an image frequency sufficiently removed from the incoming signal frequency to allow the front end coils to provide the required image attenuation. Usually, 50 db image attenuation is adequate for most communications receivers. Where practical, the image frequencies should lie outside of the band of frequencies to be tuned and should not occur on any frequency where a known station of high power is transmitting. Such stations would be government short wave broadcast stations. With these considerations in mind, the first *if* was chosen to be 2.2 mc.

At this point, it was evident that with a last *if* of 85 kc, the associated image frequencies were too close to the first *if*, 170 kc away from center frequency, to be sufficiently attenuated by the first *if* tuned circuits. For this reason, it was decided to employ triple conversion. It was found that with a second if of 455 kc, the image frequencies associated with the third conversion step could be adequately attenuated. Likewise, the image frequencies produced in the second conversion step could be attenuated by the 2.2 mc *if* transformers.

Another factor considered in the development was the frequency of the local oscillators and their harmonics. As far as practical, the frequencies of the oscillators were chosen such that their harmonics fell outside of the pass band of the receiver.

Front End and Crystal Calibrator

The rf amplifier, Q_1 in Fig. 2, consists of a single stage common base amplifier with single tuned input and output coils. It covers all amateur radio frequencies between 3.5 mc and 30 mc in five steps.

Reverse AGC is applied to the base of Q_1, and its Quisent current is set to provide minimum noise figure when low level signals are being received. For the Dalmesa transistor used in this circuit, minimum noise figure is

CLIFF-DWELLER

by ***NEW-TRONICS***

the home of originals

FIRST and ONLY

Remotely tuned

ROTATABLE DIPOLE

for 40 and 75 meters
also 10 meters

If you live in a congested area or on a small lot you can still operate beautifully on these two popular bands with a CLIFF-DWELLER CD 40-75. Band switching and tuning are performed on the control unit located at the transmitter. Extremely flat VSWR of 1.1 to 1 over entire band. This antenna is a MUST for thousands.

Model CD 40-75.......... $129.50

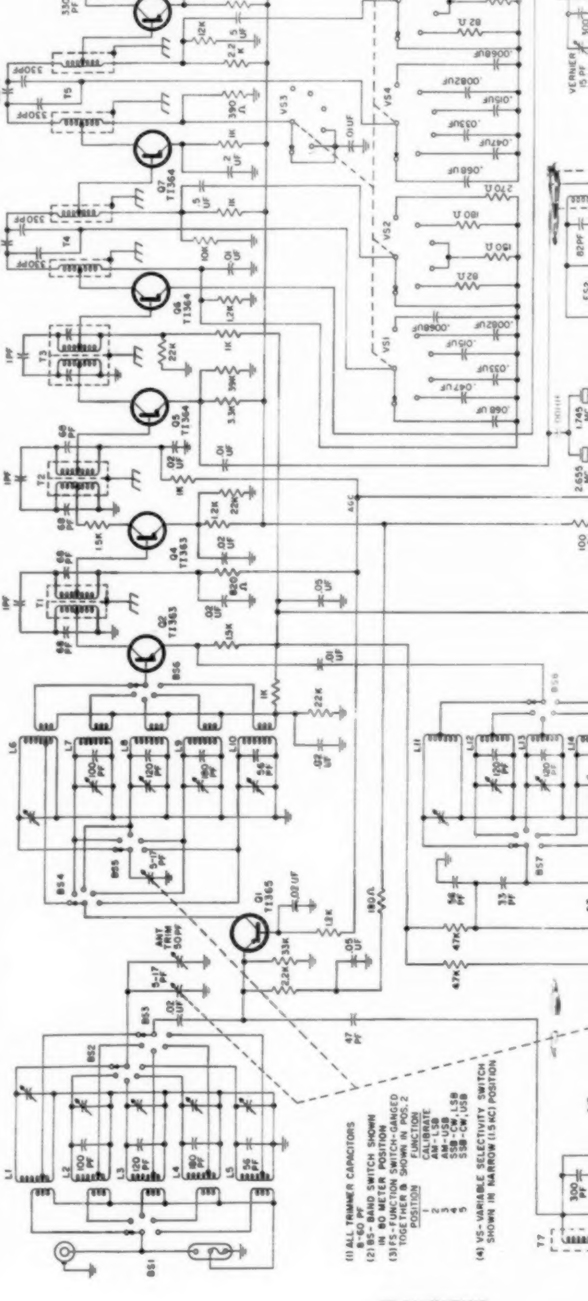
See the CLIFF-DWELLER at your distributor or write for comprehensive literature.

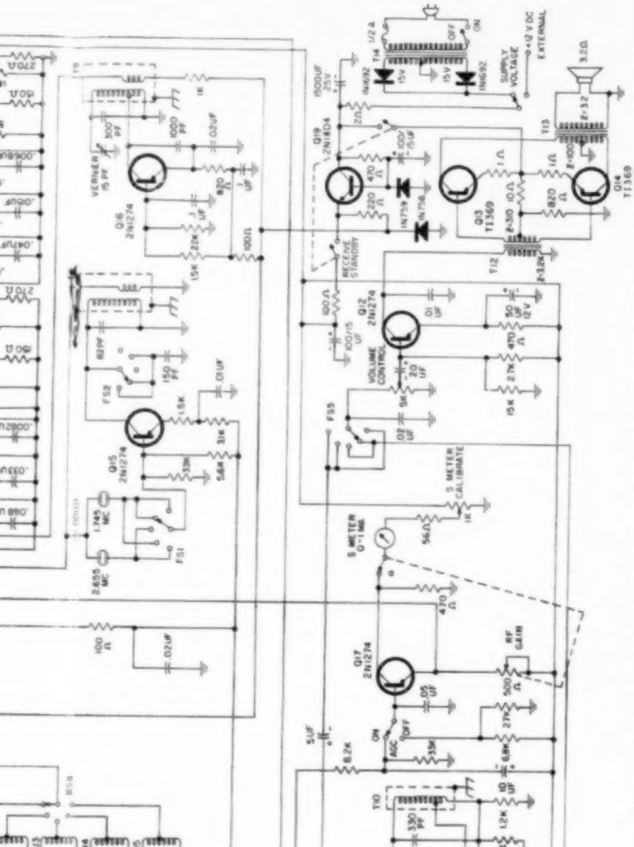
NEW-TRONICS CORPORATION
"the home of originals"
3455 Vega Ave., Cleveland, Ohio 44113

produced with a collector current of approximately 300μa. This collector current is also an ideal current at which to operate for AGC reasons as is shown in Fig. 3. At this current level h_{fe} has started to decrease quite rapidly with decreasing collector current and, therefore, a small decrease in current will produce a relatively large decrease in gain of the stage. To improve the overload performance and AGC characteristic, the emitter of Q_1 is biased from a voltage divider network rather than with the conventional single resistor. The voltage divider on the emitter of Q_1 holds a negative voltage at its emitter with respect to B+ when Q_1 is not conducting. In order for collector current to flow, the base of Q_1 must be more negative than its emitter by an amount equal to the V_{BE} required to produce the desired collector current. This negative base voltage is derived from the AGC line and applied to the base of Q_1. The AGC voltage, being a function of incoming signal strength, is capable of being reduced to zero under strong signal conditions. With a conventional circuit, the current through Q_1 would be reduced to zero when the AGC voltage applied to its base is reduced to the value of V_{BE} required just to sustain collector current flow or approximately .15 volts. With the voltage divider circuit, the current through Q_1 is reduced to zero when the AGC voltage drops to the value of the emitter bias voltage plus the value of V_{BE} required just to sustain collector current flow. With the voltage divider on the emitter, the current through Q_1 and, therefore, its gain is reduced at a much faster rate for increasing signal strength than is ordinarily achieved with conventional bias, and thereby producing a better AGC characteristic.

The choice of the loaded Q of the antenna and rf coils is selected as a compromise between image rejection, noise figure and physical size. As previously stated, a high quality receiver should have at least 50 db image rejection and at least a 1 μv sensitivity or better for a 10 db signal to noise ratio. For any given physical coil size, the signal to noise ratio may be improved by sacrificing image ejection and vice versa. It was decided that this receiver should have at least the above mentioned specifications in addition to a small physical size.

Tuned circuit theory for two single tuned coils will yield a value of loaded Q to achieve the desired attenuation at the image frequency. The loaded Q of the antenna coil was made as low as possible to keep its loss to a minimum, since loss in the antenna coil con-


(1) ALL TRIMMER CAPACITORS 8-60 PF
(2) BS- BAND SWITCH SHOWN IN 80 METER POSITION
(3) FS-FUNCTION SWITCH-GANGED TOGETHER & SHOWN IN POS. 2
POSITION FUNCTION
1 CALIBRATE
2 AM-LSB
3 AM-USB
4 SSB-CW, LSB
5 SSB-CW, USB
(4) VS- VARIABLE SELECTIVITY SWITCH SHOWN IN NARROW (1.5 KC) POSITION
Q1 TI365
Q2 TI363
Q4 TI363
Q5 TI364
Q6 TI364
Q7 TI364
Q8 TI364
ANT TRIM 50PF
AGC
VERNIER 15 PF
BS1
BS2
BS3
BS4
BS5
BS6
BS7
VS1
VS2
VS3
VS4
VS5
T1
T2
T3
T4
T5
T6
T7
L1
L2
L3
L4
L5
L6
L7
L8
L9
L10
L11
L12
L13


Q19 2N1804
Q13 TI369
Q14 TI369
Q16 2N1274
Q12 2N1274
Q15 2N1274
Q17 2N1274
Q11 2N1274
Q10 2N1274
Q9 2N1274
Q3 TI395
Q18 TI364
T7
T10
T11
T12
T13
T14
1N1692
1N759
1N756
1N295
SUPPLY VOLTAGE
+12 V DC EXTERNAL
ON
OFF
3.2Ω
RECEIVE STANDBY
VOLUME CONTROL
VERNIER 15 PF
S METER CALIBRATE
S METER 0-1 MA
RF GAIN
AGC
BFO PITCH
NOISE LIMITER
FS1
FS2
FS3
FS4
FS5
FS6 CALIBRATE
1.745 MC
2.655 MC
100 KC
40MH

tributes directly to the noise figure of the receiver. The loaded Q of the rf coil was made somewhat higher to provide proper image rejection. The image frequency for this receiver which must be attenuated by the rf coils is 4.4 mc or twice the first *if* above the desired signal frequency. The rf coils of this receiver were designed to provide at least 60 db rejection on the three lowest bands and at least 50 db rejection on the two highest bands to their associated image frequencies.

The first mixer stage, Q_2, is a conventional common emitter stage. The incoming rf signal is applied to its base and converted to the first *if* 2.2 mc. The oscillator injection voltage is applied to the emitter of Q_2 through a capacitor from the oscillator tank coil.

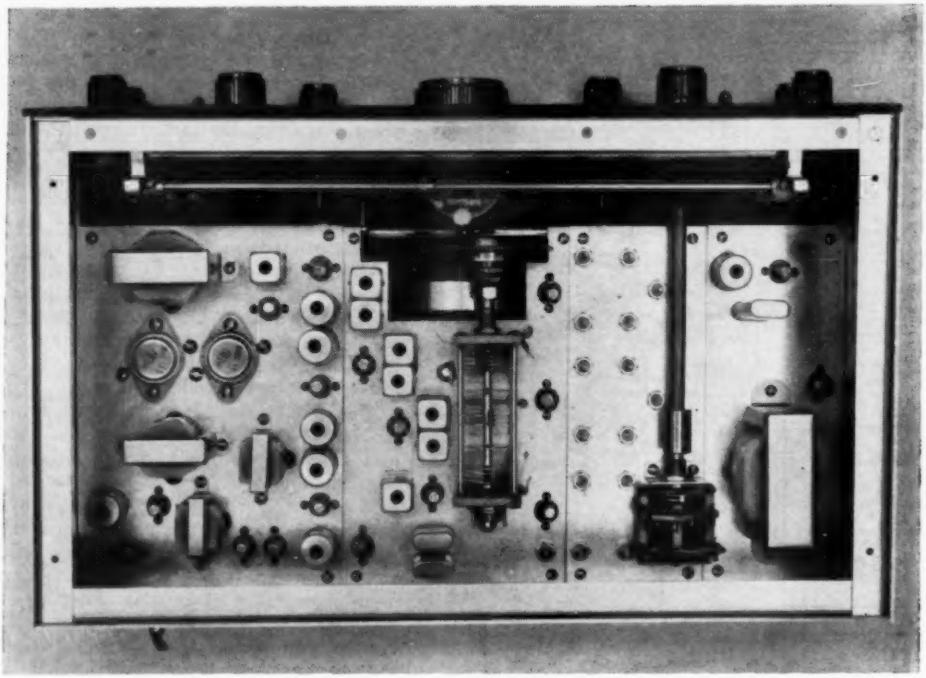
The first conversion oscillator, Q_3, is a common base Colpits circuit. The oscillator tank coil is tapped at a point which provides approximately 500 mv of oscillator injection voltage to the emitter of Q_2. The conversion gain of the first mixer is a function of the oscillator injection amplitude. Any injection voltage between 0.1 v to 1 v provides maximum conversion gain. At injection levels above or below these limits, a reduction in conversion gain occurs. Large signal levels cause spurious responses to be generated if the injection voltage is much lower than 500 μv. Larger injection voltages are not necessary but could have been used if so desired up to the upper limit of approximately 1 v.

The 100 kc calibrator, Q_{18}, is a crystal oscillator circuit which provides harmonic signals every 100 kc through the frequency range of the receiver. This signal is fed into the emitter of Q_1 when it is desired to check the receiver calibration. The incoming signal from the calibrator oscillator is "zero beat" against the bfo and the dial pointer set to the proper division on the receiver dial.

First if Stage

The first *if* stage consists of a single common emitter amplifier with double tuned input and output transformers. The image frequencies which are attenuated by this *if* stage are two times the second *if* above and below the incoming signal. These two frequencies are converted in the first mixer to produce either 2.91 mc or 2.09 mc. The loaded Q of the two double tuned first *if* transformers was chosen to provide at least 60 db attenuation to these two image frequencies.

For maximum signal handling capabilities, the collector of Q_4 should be loaded into an impedance equal to the collector-emitter voltage divided by the collector current. Un-



der large signal conditions, the collector current is at a minimum since it is controlled by the AGC line. This dictates that the collector see as high an impedance as possible for overload reasons. On the other hand, if the collector is loaded into too high an impedance, instability can occur. The collector was, therefore, fed into an impedance which was somewhat lower than that desired for maximum signal handling capabilities, and somewhat higher than that desired for maximum stability. Overloading usually occurs in later stages in the receiver. Therefore, this may be done with no sacrifice in overload ability. The voltage divider on the emitter of Q_4 is used for the same reason as that of the rf stage.

Second and Third Conversion Stages

The method used to achieve the second and third conversion steps is illustrated in the schematic. As explained earlier, the 455 kc transformer is used to provide attenuation to the third conversion image frequencies. These image frequencies are two times the third *if* of 170 kc either side of the desired incoming rf signal. These frequencies are converted to either 285 kc or 625 kc and are rejected at the 455 kc tuned circuit.

In general, there will be only one direct image frequency associated with each conversion step. However, since the second local oscillator operates either 455 kc above or below the first *if*, there are two additional image frequencies associated with this receiver. These two extra image frequencies are symmetrically spaced above or below the center of the *if* with respect to the normally associated images. Therefore, if the *if* transformers are designed to reject the normal images, the two additional images will also be rejected.

With the type of variable selectivity used in the 85 kc *if* strip, the center frequency

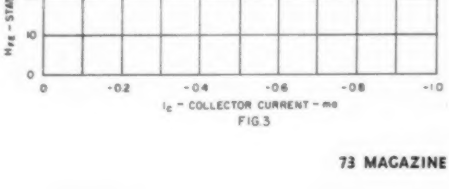
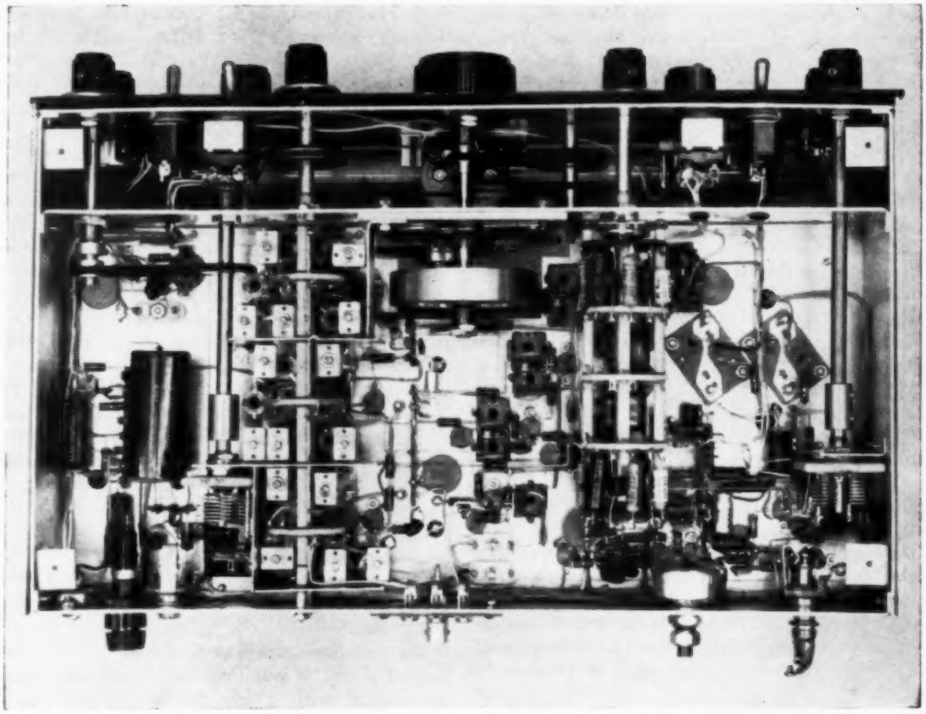


FIG.3



of the band pass moves up in frequency as the bandwidth is increased. In other words, 85 kc is the center frequency when the bandwidth is minimum, and 88 kc is the center frequency when the bandwidth is maximum. When receiving SSB signals, the carrier insertion frequency is set at 85 kc. For proper reception with this arrangement, both upper and lower sideband signals must appear as an upper sideband signal at the input to the 85 kc *if* strip. For this reason, the second conversion oscillator operates either above or below the first *if* depending on whether upper sideband or lower sideband is desired.

The signal from the 2.2 mc *if* amplifier is applied to the base of Q_5, the second mixer. Oscillator injection is applied to the emitter of Q_5 and its output is tuned to 455 kc, the second *if*. The emitter of Q_5 is biased from a voltage divider in the same manner as Q_1 and Q_4, the other two AGC'd stages.

The output of the 455 kc transformer is applied to the base of the common emitter third mixer stage, Q_6. The output of Q_6 is applied to the double tuned input transformer of the 85 kc *if* strip. Oscillator voltage is injected into the emitter of Q_6 through a secondary winding on the oscillator coil in series with its emitter resistor.

The reception of a single sideband signal on any receiver requires that the signal into the *if* strip be within approximately 50 cycles of its original frequency with respect to the injected carrier in order to properly recover the modulation. This criteria makes the receiver front end setting very critical and on many receivers, it is difficult to properly tune

Coil	Primary	Tap	Secondary	Tap
2.2 mc if	50 T #38	35 T	55 T Litz	1 T
455 kc if	165 T #40	80 T	165 T #40	2 T
85 kc input	525 T #39	260 T	525 T #39	20 T
85 kc interstage	525 T #39	208 T	525 T #39	28 T
85 kc output	615 T #40	212 T	112 T #40	none
2nd conv. osc.	60 T Litz	none	6 T #38	none
BFO	525 T #38	33 T	none	none
100 kc osc.	525 T #38	none	none	none
3rd conv. osc.	167 T #40	59 T	10 T #40	none

Coil forms are Elrad or Radio Industries cup core type. Litz wire is 5/44.

such a signal. This problem becomes more pronounced on the wider amateur radio bands since for equal degrees of rotation of the tuning gang the frequency coverage is increased. For these reasons, it was decided that a "vernier" of fine frequency control would be desirable when receiving single sideband signals. This fine tuning control was realized by making the frequency of the third conversion oscillator variable over approximately a 6 kc range. This allows the 455 kc signal to be converted to 85 kc ± 3 kc so that the incoming signal may be placed anywhere in the passband of the 85 kc *if* strip. Since this control is independent of the front end tuning, the same fine degree of tuning on all amateur bands was realized. This control proved to be particularly useful when more than one station on slightly different frequencies was being alternately received.

The second conversion oscillator, Q_{15}, is a conventional common emitter crystal oscillator. Its emitter resistor was split and left partially unbypassed to provide some negative feedback. This negative feedback serves to reduce the harmonic content of the oscillator injection voltage. The third conversion oscillator is a conventional common base circuit and is tunable over a 6 kc range as previously explained.

85 kc if Amplifier

The variable selectivity 85 kc *if* strip is shown in Fig. 2. It consists of two double tuned transformers and one single tuned transformer used in conjunction with two common emitter amplifiers, Q_7 and Q_8. Variable bandwidth is achieved by changing the Q of the secondary and the coupling between the primar and secondary of the two double tuned transformers. The Q of the secondary is lowered by switching resistors in series with its low end. The primary and secondary are coupled through a common capacitor connected to their low end. The coupling is increased by switching in smaller value common low end capacitors. At the same time, the secondary Q is lowered, the coupling between primary and secondary is increased and the bandwidth is made wider. One distinct advantage of this system is that all switching is accomplished at low impedance points which practically eliminates lead length and layout problems. It was mentioned earlier that the center frequency of the *if* bandpass shifted up as the bandwidth was increased. This occurs because the switched coupling capacitor is part of the tuning capacity for both the primary and secondary windings. This capacitor is reduced as the bandwidth is increased and it causes the center frequency of the bandpass to be shifted. The bandwidth of this receiver was made variable from 1.5 kc to 6 kc in six steps. Narrower bandwidths could be achieved by using coils with higher unloaded Q but again, as in the front end, physical size of the receiver being a design objective limited the physical size and, in turn, the unloaded Q of the 85 kc coils.

To provide minimum insertion loss in the output *if* coil, it was decided to make it single tuned and with a low loaded Q. Minimum loss in this coil provides more available power for AGC purposes. It, therefore, provides very little if any selectivity to the overall response of the *if* strip.

The collector of each transistor is fed into an impedance which enables maximum signal handling capabilities. It can be shown that this impedance is equal to the collector to emitter voltage divided by the collector current.

(Turn to page 90)

Band	Antenna Coils			R F (Mixer) Coils			Oscillator Coils	
	Primary	Secondary	Tap	Primary	Secondary	Tap	Primary	Tap
80m	6 T #38	50uh 68 T Litz	6 T	2 T #38	50uh 68 T Litz	30T	12uh 35 T Litz	3 T
40m	3-1/4 T Litz	4.65uh 28 T Litz	3-1/4 T	2 T #30	4.65uh 28 T Litz	none	2.1uh 17 T #26	2-1/2 T
20m	2 T #26	.75uh 12 T #24	3-1/2 T	3-1/2 T #26	.75uh 12 T #24	none	.47uh 10 T #22	1-1/2 T
15m	1-1/4 T #23	.27uh 6 T #20	2 T	3 T #26	.27uh 6 T #20	none	.20uh 6 T #20	1-1/4 T
10m	1 T #24	.36uh 8 T #21	2 T	2 T #26	.36uh 8 T #21	none	.29uh 8 T #20	1-1/4 T

80m, 40m and antenna and rf coils for 20m are close wound. Others are spaced the length of the form. Trimmers are ARCO 403 except for 15m, which uses ARCO 404. Coil forms are all CTC-PLS62C4L/20063. Use suffix E (red slug) for 80, 40 and 20, suffix D (white slug) for 10m and 15m oscillator and suffix O (green slug) for 15m antenna and rf.

FREE

$49.98 VALUE

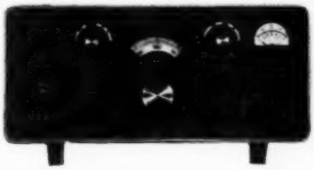
Get this E-V 664 Dynamic Microphone

"Absolutely the world's finest SSB microphone"

With purchase of any SSB transceiver shown—this month only.

Freight free with cash orders.

COLLINS

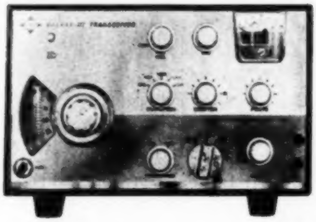


KWM-2	1150.00
516F2 (AC)	115.00
MP-1 (DC)	198.00

DRAKE

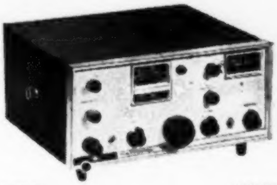
TR-3	550.00
AC-3	79.95
DC-3	129.95

GALAXY



Galaxy III	349.95
A.C. Supply	79.95
D.C. Supply	119.95

NATIONAL

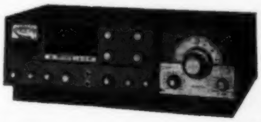


NCX-3	369.00
NCX-A	110.00
NCX-D	119.50

SBE

SB-33 w/A.C. P/S	389.50
SB-2 DCP	79.50

SWAN



SW400	395.00
406 VFO	75.00
420 VFO	120.00
512 D.C.	145.00
117B	85.00

HALLICRAFTERS

SR160	349.50
P150AC	99.50
P150DC	109.50

MISSION HAM SUPPLIES

3316 Main Street
Riverside 3, California 92501
Phone 683-0523 (area code 714)

Simplified Transistor Biasing

Richard Taylor K2HQY
308 Stratford Road
Brooklyn 18, N. Y.

Transistor biasing is a subject which has been extensively discussed in many magazines, both amateur and professional. Because the transistor is a non-linear device (that is, E=IR does not hold over its entire range of operation) these discussions have often been quite complex and difficult to apply to real life situations. You may often bypass these difficulties by assuming that the transistor has certain linear properties, using Ohm's Law (and other circuit equations) to calculate the voltages and currents required, and then modifying the circuit when you get it on a breadboard to eliminate those cases where the assumptions didn't quite work. In many cases the breadboard circuit will work exactly as predicted and this last step won't be necessary.

One thing you should remember at the start is that even today, most experimenters transistors (i.e. the CK-722, or the 2N1302) will vary so much from their published characteristics that you might as well not have them. For example, the Beta of a 2N1302 may vary anywhere from a low of twenty to a high of infinity (well, not quite that high, but there is no published upper limit). What to do then? In designing a circuit it's nice to be able to predict what you can expect from it when it is constructed so you will know when you have it optimized. This involves a little mathematics. To be sure, you can avoid the mathematics all together and bias your transistor as shown in Fig. 1. All you have to do is turn the knob on the pot marked Rb until the stage amplifies.

While that is all you have to do, it might be added that it is all you will be doing. Every time you change transistors, or the temperature changes, or some part changes value, or (more than likely) every time the moon changes phase you will find yourself diddling with Rb. This is not a good biasing system.

Fig. 1 is good for one purpose though. Notice the polarities used to bias the transistor. This is an NPN transistor. The collector and the base are both made positive with respect to the emitter. This makes the collector-base junction reverse biased and the base-emitter junction forward biased. This is the normal operating condition for a transistor amplifier. If the transistor were PNP, exactly the opposite polarities would hold but the collector-base junction would still be reverse biased and the base-emitter junction would still be forward biased.

You may wonder how it is known that the collector base junction is reverse biased when the collector supply voltage is connected between the collector and emitter. The answer lies in the fact that a forward biased diode (such as the base-emitter junction) has only a small voltage across it. This voltage has the polarity shown in Fig. 1 and, except for very high temperatures, will have a magnitude of less than a volt. This voltage is commonly designated V_{BE}. Now V_{BE} opposes the collector supply voltage so that the collector-base voltage is V_{CC}-V_{BE}. Since we can keep V_{CC} greater than a volt, the collector-base voltage is positive and this junction is reverse biased.

If this is not completely clear to you think of it this way. Imagine another arrowhead on the transistor symbol, this one on the collector lead pointing in the same direction as the one on the emitter. We know that the base-emitter junction is forward biased since conventional current (which flows from positive to negative) travels through this junction in the same direction as the arrowhead is pointing. The collector is positive with respect to the base which means that conventional current will flow from the collector to the base. This is opposed to the direction indicated by our imaginary arrow on the collector lead so this junction is reverse biased. See Fig. 2.

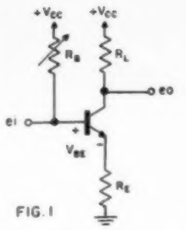


FIG. 1

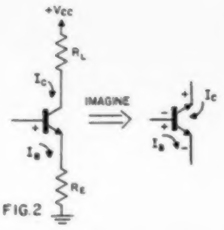


FIG. 2

It was mentioned above that the base-emitter voltage will always be some low value because this junction was forward biased. We can be more specific than this and say that at room temperature (70 degrees F.) this voltage will be about 0.3 volts for a germanium device and 0.6 volts for a silicon device. In designing our circuits we can assume V_{BE} to be constant at one of these values. Which one we choose depends, of course, on whether our transistor is germanium or silicon.

One more assumption and we can get to work. We will assume that the collector-emitter voltage (V_{CE}) of the transistor will be from one-half to one-third of the collector supply voltage when we are designing circuits. It does not matter exactly what this voltage is as long as it is greater than a couple of volts and meets the above requirement.

Using the above assumptions we may design transistor amplifier circuits which will be relatively insensitive to transistor and temperature changes and which may be designed for a specified gain. Actually, what we will be doing is making extensive use of negative feedback in the form of an unbypassed emitter resistor.

Let's first analyze (as opposed to design) a simple transistor amplifier to get a feel for the mathematics involved. All that is required is a knowledge of a few simple circuit equations, like Ohm's and the voltage divider laws.

Fig. 3 is the circuit to be analyzed. Assume that the transistors are germanium and that each has a beta of 100.

First of all, by the voltage divider equation we may find V_{B1}. Assume that the base current is small enough to be ignored (remember we are approximating!). Get out your slide rule and check these calculations if you want to get the most out of the example.

$$V_{BI} = \frac{3.3K}{3.3K + 18R} \times 12v = 1.8\%$$

Now, since this is a germanium transistor we know that the base-emitter voltage of the first stage must be 0.3 volts. Therefore, V_{E1}

NOW!

20,000 ohms per volt DC

PORTABLE MULTIMETER

9.95

Allow 50c for packing and shipping. California residents include 4% sales tax.

OUTPUT
OHMS ADJ
(+) 2.5KV
+ V-Ω-A
— COM

20,000 OHMS per VOLT DC
1% Precision Resistors

RANGES: AC volts: 0-10-50-250-1000; DC volts: 0-5-25-125-500-2500; DC current: 0-250 mil, 0-50 microamp; OHMS: 0-10,000 & 1 meg. Expanded low-ohm scale. DB: —20 to +22
Test Leads: Leather Carrying Case

QUEMENT ELECTRONICS

1000 SOUTH BASCOM SAN JOSE, CALIFORNIA
"Northern California's Most Complete Ham Store"
SINCE 1933

must be

$$V_{EI} = V_{BI} - V_{BEI} = 1.87 - 0.32 = 1.5\%$$

We now know the voltage across the emitter resistor in the first stage and may calculate the emitter current.

$$I_{EI} = \frac{V_{EI}}{1.5K} = \frac{1.57_V}{1.5R} = 1.04 \text{ ma, say 1 ma}$$

Since we are assuming that the base current is very small, we may say that the emitter and collector currents are about the same, or $I_{C1} = 1$ ma. Actually $I_E = I_C + I_B$. This is one of the basic expressions of transistor circuit analysis and it is a good one to remember. The drop across the collector resistor may then be computed to be

$$1\text{ma} \times 6.8K = 6.8v$$

and

$$V_{CI} = V_{CC} - 6.8v = 12 - 6.8 = 5.2v$$

This completes the calculations on the first stage. By looking at the diagram you can see that $V_{B2} = V_{C1}$ so that $V_{B2} = 5.2$ volts. We may then find V_{E2} using the same method as applied to the first stage

$$V_{EZ} = V_{BZ} - V_{BEZ} = 5.2 - 0.3 = 4.9v$$

and

$$I_{EZ} = \frac{V_{EZ}}{4.7K} = \frac{4.9v}{4.7K} = 1.02 \text{ ma, say 1 ma}$$

We now have computed all the voltages and currents associated with this two stage amplifier. But what about gain? An exact calculation would involve the use of h-parameters and a lot of algebra. We can come pretty close by the following method.

The gain of any device is defined as the ratio of the ac output voltage to the ac input voltage. Our first stage gain would then be V_{cl}/V_{bl} where the small subscripts indicate ac voltages. Now, we know that $V_e = V_b - V_{be}$ (the same expression as used for dc voltages). In other words, the emitter voltage is always equal to the base voltage minus some constant. If the base voltage goes up, so does the emitter voltage; if the base voltage drops, so does the emitter voltage. The emitter voltage tends to "follow" the base voltage. This is where the term "emitter follower" comes from.

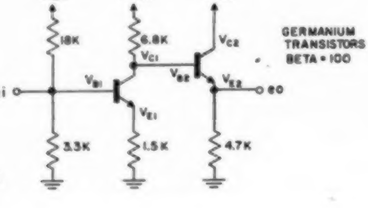


FIG.3

We may then write the gain expression as V_{el}/V_{el}. Since the collector current is approximately equal to the emitter current the gain of this first stage must be $R_C/R_E = 6.8K/1.5K = 4.55$. Since the second stage is an emitter follower and has a gain of one (again, approximately) the overall amplifier gain is 4.55 also.

This assumes there are no loading effects from stage to stage. There are loading effects of course, but ignoring them in a case like this will not make you very wrong. The actual circuit gain may be about 4.0.

To get some idea of just how much loading does exist you may use the following expressions which were derived from h-parameter equivalent circuits.

For an emitter follower:

$$R_{in} = \text{beta} \times R_E$$
$$R_{out} = R_B/\text{beta}$$

where R_B is the two resistors of the base voltage divider taken in parallel. In the case of the second stage of Fig. 3, R_B is the collector resistor of the preceding stage or 6.8K. R_{in} does not include the effect of any resistors that may be connected to the base (such as a voltage divider used for brasing). Should any resistances be connected to the base they must be taken in parallel with R_{in}. For regular common emitter amplifier the input impedance is the same os for the emitter follower (approximately). The two resistors of the biasing divider are taken parallel with R_{in}. Often this input impedance will be the same as the lower resistor in the divider. The output impedance of a common emitter amplifier is essentially R_C, the collector resistor.

The input impedance of the second stage of Fig. 3 is then (assuming beta equals 100)

$$R_{in} = 100 \times 4.7K = 470K$$

Before I get some nasty fan mail, let me hasten to add that there is an upper limit to the input impedance that you can get from an emitter follower. This is in the range of 70 to 100K. If your computations yield an input impedance higher than this (as they did here) you may rest assured that you are getting the maximum input impedance possible from your circuit and that it is in the range mentioned before. Remember that these calculations are all approximate and you must take them with a grain of salt. Notice

LAFAYETTE RADIO ELECTRONICS

THE CHOICE OF VALUE-CONSCIOUS AMATEURS THE WORLD OVER

80 40 20 15 10

Imported

LAFAYETTE "PRECON" AMATEUR PRESELECTOR CONVERTER

49.50

MODEL HE-73

- Crystal Controlled
- For 80-40-20-15-10 Meter Bands
- As a Converter—Converts Receiver to Dual Conversion Operation
- Improves Selectivity
- Widens Band Spread

A great 2-in-1 combination. Tuned interstage circuits and 2 stages of RF amplification assures higher signal-to-noise ratio, improved I.F., image rejection. Easy to install.

PROFESSIONAL-QUALITY 14-TUBE COMMUNICATIONS RECEIVER MODEL HE-80

129.50

Imported

- Dual Conversion on 6 Meters
- 5-Bands: 550KC-54MC
- Product Detector Circuit for Improved SSB Reception
- Separate BFO and Q-Multiplier Circuits (can be used simultaneously)
- Crystal Calibrator
- Efficient Superheterodyne Circuit
- Effective Automatic Noise Limiter
- Voltage Regulated Power Supply

Features outstanding sensitivity, Q-Multiplier selectivity and electrical bandspread, makes a handsome addition to your ham shack. Calibration crystal is sold optionally.

LAFAYETTE MAIL ORDER
& L. I. SALES CENTER
111 Jericho Turnpike,
Syosset, L.I., N. Y.

OTHER LOCATIONS

Jamaica, N. Y.	Newark, N. J.
Scarsdale, N. Y.	Plainfield, N. J.
New York, N. Y.	Paramus, N. J.
Bronx, N. Y.	Boston, Mass.
Natick, Mass.,	Brooklyn, N. Y.

Free!

LAFAYETTE
ELECTRONICS

Send for Big New 422 page 1964 Catalog

LAFAYETTE RADIO ELECTRONICS
Dept. 73H-4 P.O. Box 10
SYOSSET L. I., N. Y. 11791

☐ Please send me new 1964 Catalog 640

☐ Ship Stock No. .... $........... enclosed.

NAME ....

ADDRESS ....

CITY .... ZONE .... STATE ....

though, that this approximate calculation has told us that the second stage will not load the first. A 70K resistor hung in parallel with a 6.8K resistor will yield a parallel combination of just about 6.8K. This leads to a good rule to remember. Whenever you have two resistors in parallel and one is greater than ten times the other the parallel combination has a value about equal to the smaller resistance. This can be worked downward somewhat so that even if the larger resistor is say, seven times the smaller, the result is still pretty good but you shouldn't go much lower than this.

The output impedance of the second stage (and hence of the amplifier) is

$$4.7\text{K}/_{100^2} = 47\text{r}$$

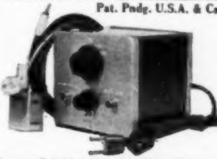
Just as there was an upper limit on the input impedance there is a lower limit on output impedance, somewhere in the vicinity of ten to twenty ohms. You can see we didn't get close to it here.

This completes the *analysis* of this circuit. *Design* is essentially going in the other direction. Starting with desired voltages and currents we work towards component values. Design is not so straight forward as analysis and leans heavily on experience. Unfortunate-

TRANSTENNA 102A

A PRESELECTOR SECOND TO NONE AND A T-R SWITCH BEYOND COMPARISON

Pat. Pndg. U.S.A. & Canada



MODEL 102A

$69.45 (Add $7 for Sidetone — either model)

15 DAY TRIAL

Return For Full Refund If You Burn It Out Or Are Not *FULLY PLEASED*

- Std. coax coupler (xmtr to feedline)
- No TVI or Suck out
- 30 DB Min. Gain (10-80 mtrs)
- No Effect on Transmission
- Monitored switching
- Full Legal Input
- Burnout Proof
- CW Sidetone (optional)

Write for Free Literature

Improved 102A Adjustable Mute Circuit Breaks Any Xmtr-Rcvr Between Dots & Dashes Without Clicks. Improved Semiconductor Through-Position Switch Switches Rcvr Directly to Antenna for Unity Gain 6-80 Mtrs.

102B, $59.00 like 102A exc. rcvr. muting

FICHTER ELECTRONICS
33 Myrtle Avenue
Cedar Grove, N. J.
Tel: CEnter 9-6412

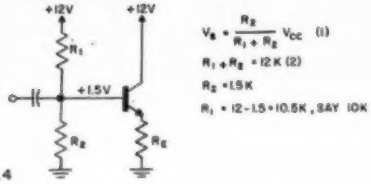
6 & 2 METER PRE-AMPS

- Single Nuvistor (6CW4) +25DB. 2½"x2". P.C. Board, wired & tested. For 2 meters .... #2PA—$3.50
- Cascode Nuvistor (2-6CW4) 2½"x2". +20DB. For 6-2 & C.B. P.C. Board, wired .... #PA-C—$4.00
- 6 Meter All Nuvistor Convertor (4-6CW4). A very low noise Hi-gain unit. Equal or superior to any unit available. P.C. Board—2½"x4"—Any I.F.—wired ... #6MC-N—$6.50
- 2 meter Model—10mc—I.F. .... #2MC-N—$7.50
- 2 meter Super-Regen-Receiver. (1—6CW4 osc. & 1—6U8 audio) IMV. Full audio to speaker. P.C. Board, wired #2MSG—$6.50
- Standard 2 meter Converter (1—6CW4, 1—6X8) P.C. Board, wired—2½x4". Any I.F. .... #2MC-X—$6.50
- "Little Gem" 6 meter driver unit & transmitter. All you need on 6. 5 watts in 3 watts out. Uses 8MC Xtals. P.C. Board 2½"x4", wired. Uses (1—6AU8). From W4BIR—Have worked 19 states—Remarkable performance. #XT—$6.50
- Audio Board for above (1—12AX7, 1—6AQ5) carbon or xtal mike. .... #MA—$5.00

GEM ELECTRONICS

Printed Circuit Converters & Transmitters

P.O. BOX 203 TREMONT CITY, OHIO



$$V_B = \frac{R_2}{R_1 + R_2} V_{CC} \quad (1)$$

$$R_1 + R_2 = 12K \quad (2)$$

$$R_2 = 1.5K$$

$$R_1 = 12 - 1.5 = 10.5K, \text{ SAY } 10K$$

FIG. 4

ly you can't get experience without designing, you can't design without experience . . . and so on. You can break into this vicious circle without getting too dizzy by applying the approximations we used in analyzing the circuit of Fig. 3.

Let's first of all design a simple emitter follower. You might want to use this circuit between two regular common emitter amplifiers to prevent the second stage from loading the first. This is, in fact, a most common use for emitter followers. The important parameter when biasing transistors from a voltage standpoint (and that is what we are really doing here) is the transistor base voltage. It must be high enough so that the swing of the input signal does not reverse bias the base-emitter diode at any time during the input cycle. Then again, it must not be so high that the transistor goes into saturation at any time during the cycle. We are looking for a middle point.

Assume a 2.0 volt (peak to peak) input swing. If we are using a 2N1302 (which is germanium) we would then have to set the base to at least 1.3 volts, 1.5 volts would be better and 2.0 volts better yet. This will insure that the base-emitter junction will never be reverse biased. Assume that we choose a base voltage of 1.5 volts. This means that the input signal swings between 0.5 and 2.5 volts. If saturation is going to occur it will occur at the 2.5 volt point. When the base is at this voltage, the emitter is at 2.2 volts leaving 12-2.2, or 9.8 volts across the transistor (assuming $V_{CC} = 12$ volts as an example). Since the transistor has some voltage across it it is not saturated (or anywhere near it in this instance). Saturation occurs when V_{CE} is forced to drop to zero volts.

Most of the time an emitter follower just won't saturate. This may seem like a rash statement but it is borne out in practice. It has to do with the fact that for a series of stages all run off the same collector supply the emitter follower stages all have greater V_{CE} than the regular common emitter amplifiers (due to the absence of the collector resistors). This means a higher saturation voltage on the base. If the regular amplifiers are not saturating for a given input signal the emitter followers can't possibly saturate either. At least, not if they are direct coupled as shown in Figure 3.

So we want to put 1.5 volts positive (the 2N1302 is an NPN transistor) on the base. A simple voltage divider will do this nicely as shown in Figure 3. Here is one point where you must rely on experience. Just how much bleeder current do you want to draw through R1 and R2. To make the current too large is wasteful, to make it too small is to ruin our approximations and the stability of the stage. A general rule of thumb might be to make the bleeder current from five to ten times as large as the base current, say, somewhere around one mil. With 12 volts for V_{CC}, this makes the sum of R1 and R2 equal to 12K. Now we can solve the two equations shown in Fig. 4 for R1 and R2. We find that R1=10K and R2=1.5K.

After you've chosen standard value components to use in your circuit go back and compute the actual base voltage to make sure the value you end up with does not cutoff the transistor. In this case the base voltage comes out slightly higher than 1.5 volts so the result is OK. The sum of the two resistors is also quite close to 12K. Next, R_E is chosen from a knowledge of the desired emitter current. Unless it is driving a very heavy load, a 2N1302 will operate quite nicely on under one mil. Assuming I_E equal to one mil, we find R_E to be

$$R_E = \frac{V_B - V_{BE}}{I_E} = \frac{1.5\text{v} - 0.30}{1\text{ma}} = 1.2\text{K}$$

More often than not, you can avoid the necessity of computing a divider by direct coupling the emitter follower to the collector of the previous stage. This is shown in Figure 5. Direct coupling also eliminates the drop in input impedance caused by the low impedance voltage divider. This is the only way to insure that your input impedance will be up near the maximum attainable. The only mathematics necessary in this case is the calculation of R_E since the collector voltage of the previous stage is undoubtedly known.

So much for the emitter follower.

Now let's try to get some gain out of the transistor. It was mentioned before that 2N1302's have betas which run from twenty on up. Most units will have gains in the vicinity of 70 to 100. This means that we would usually be able to get a gain in the vicinity of 50 to 70 from a single stage of amplification. Since we want to be able to use *any* 2N1302 picked at random from stock in our amplifier we would do well to limit the gain of each stage to no higher than fifteen. Two such stages would then give us a gain of greater than 200. While it may seem that we are doubling the number of components and transistors required to get a driven gain unnecessarily, what we get in return makes the trade-off worthwhile. It becomes possible to design the amplifier easily (without having to specially select transistors or components) and with an inherent stability not necessarily present in the one stage amplifier. What we are really doing is greatly overdesigning the amplifier and including a large amount of negative feedback. It might be well to remember that, in general, the greater the amount of negative feedback incorporated in a design, the more insensitive it will be to circuit parameter variations. At the prices that experimenters transistors are available for these days (even brand new 2N1302's go for 50 cents each; 33 cents each if you are willing to buy 100) this approach to design becomes economically worthwhile.

Let's design a single stage of amplification with a gain of ten. We know from our analysis of Fig. 3 that the gain of such a stage is approximately R_L/R_E. Or, in this case, R_L must be about ten times R_E. Fig. 6 shows the circuit diagram of the stage. The transistor to be used is a 2N1302. It is normally a good idea to make V_E from five to ten times V_{BE} to minimize the variation of base voltage with temperature (as V_{BE} drifts) but in this case even using the factor of five would lead us to an unreasonably high collector supply voltage

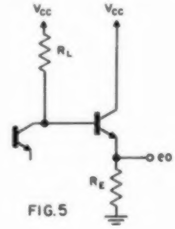


FIG. 5

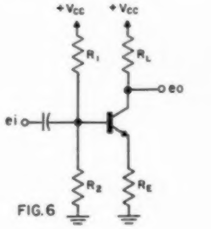


FIG. 6

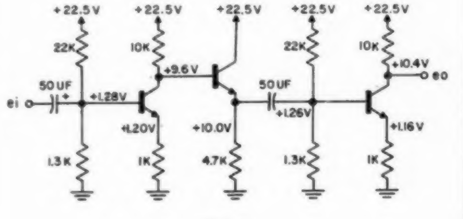


FIG. 7

send for NEW FREE CRYSTAL CATALOG with NEW TRANSISTOR OSCILLATOR CIRCUITS

3 BIG MODERN PLANTS TO SERVE YOU BETTER
2 in Fort Myers 1 in Los Angeles

HERMETICALLY SEALED PRECISION GROUND CUSTOM-MADE NON-OVEN CRYSTALS

Top performance assured with quality controlled throughout manufacture. Gold or silver plating acts as electrodes. Crystals are spring mounted and sealed under vacuum or filled with inert gas. Very high frequency stability. Max. current capacity is 10 milliwatts—5 for overtone type. Conformity to military specifications guranteed.

1000KC to 1600KC (Fund. Freq.) .... Prices on Request
1601KC to 2000KC (Fund. Freq.) ...... $5.00 ea.
2001KC to 2500KC (Fund. Freq.) ...... 4.00 ea.
2501KC to 5000KC (Fund. Freq.) ...... 3.50 ea.
5001KC to 7000KC (Fund. Freq.) ...... 3.90 ea.
7001KC to 10,000KC (Fund. Freq.) ... 3.25 ea.
10,001KC to 15,000KC (Fund. Freq.) 3.75 ea.
15MC to 20MC (Fund. Freq.) .... 5.00 ea.

OVERTONE CRYSTALS

15MC to 30MC Third Overtone .... $3.85 ea.
30MC to 40MC Third Overtone .... 4.10 ea.
40MC to 65MC Third or Fifth Overtone 4.50 ea.
65MC to 100MC Fifth Overtone .... 6.00 ea.

DRAKE 2-B Receiver Crystals $4.00
(All Channels—Order by Freq.)

OVEN-TYPE CRYSTALS

For Motorola, GE, Gonset, Bendix, etc.
Add $2.00 per crystal to above prices
SUB-MINIATURE PRICES slightly higher

CITIZEN BAND Class "D" Crystals $2.95
Over 50,000 CB crystals in stock for all sets and channels, both HC6/U and miniature types. To insure proper correlation and correct freq. operation, order by manufacturer model number and channel.

NOW . . . 48 HOUR SHIPMENT

ALL TEXAS CRYSTALS are made to exacting specifications, quality checked, and unconditionally guaranteed!

Send for new Citizen Band Crystal Interchangeability Chart with Texas Crystals Code System.

ORDER FROM CLOSER PLANT

TEXAS CRYSTALS

DEPT. 73-8
1000 Crystal Drive
FORT MYERS, FLORDA
Phone 813 WE 6-2109

AND
4117 W. Jefferson Blvd.
LOS ANGELES, CALIF.
Phone 213-731-2258

Division of
ELECTRONICS WHITEHALL CORPORATION

so a V_E of 1.0 volts was selected. Since the collector and emitter currents are almost equal this means that we must have about ten volts across the collector resistor. Putting 11.5 volts across the transistor (V_{CE}) and adding them all up gives 22.5 volts for the collector supply, which is a reasonable value (and convenient!). You should notice that the collector-emitter voltage chosen here is just about one-half V_{CC}. If we take a collector current of one milliampere (a reasonable number) we find $R_L = 10K$ and $R_E = 1K$. See Fig. 7.

Next we compute the base voltage divider in the same manner as for the emitter follower. In solving for R1 and R2 we obtain R2 = 1.3K and R1 = 21.2K. For standard components, we might use R2=1.3K and R1=22K. This divider will give you a base voltage of about 1.25 volts.

Let's now investigate the allowable voltage swings. We already know that in the negative direction a swing of 1.25-0.3=0.95 volts is allowed. As long as we do not exceed this negative swing, the base-emitter junction will remain forward biased and the transistor will not cut-off. But what about the other direction? How positive may we allow the base to swing?

Remember that under very large positive swings, the transistor will saturate causing V_{CE} to go to zero. The point at which this first occurs determines our limit. The positive swing must not be so great as to force the collector-emitter voltage to drop to zero. This maximum base swing may be found as follows. Assume that the transistor V_{CE} has gone to zero, we then have the 22.5 volt collector supply divided across the 10K collector load and the 1K emitter resistor. Treating this like any voltage divider tells us that the emitter voltage is

$$V_E = \frac{1K}{11K} \times 22.5v = 2.05v \text{ when } V_{CE} \text{ is zero.}$$

The corresponding base voltage is then

$$2.05 + 0.3 = 2.3v$$

which means that the base may swing positively a total of

$$2.34 - 1.25 = 1.15v$$

We see that in this case the allowable positive and negative swings are approximately equal. Since the negative value is slightly smaller than the positive, it controls and the allowable peak to peak swing is 1.90 volts. If, in designing your amplifier, you wish to make the swings more nearly equal you can go back and reset the base voltage (by changing the base voltage divider) to accomplish this. It's most easy to do this when you have the circuit breadboarded.

As with most circuit problems, you can of course approach this from the other direction and from a known allowable swing calculate the required base and supply voltages required. The process is the same. In all cases nothing more than the simplest of circuit formulas is required.

We now have a single stage amplifier with a gain of ten providing it is driven from a real low impedance source and feeds a real high impedance load. Any load lower than about 100K will cause the gain to drop since the effective R_L drops. This is fine if all you want to do is feed some high impedance device—like the input of a scope. But suppose you wanted to cascade two of these stages to get a gain of 100? You could go back and redesign the first stage for a new effective R_L and increase the collector supply, but there is an easier way out. Just put an emitter follower between the two stages. The high input impedance of the follower will prevent loading of the first stage by the second and at the same time provide a low impedance source to drive the second stage. This will not eliminate all the loading effects but it will help sufficiently to get the overall gain up close to 100. You can direct couple the emitter follower to the collector of the first stage (in fact you must if you are to get maximum gain) but should ac couple the follower to the second stage, like in Fig. 7.

If you calculate the gain of the three stage amplifier using h-parameters you will find that the gain may vary from 60 to 177 depending upon the particular transistors used. Since most 2N1302's have betas in the 70 to 100 range, it would not be unreasonable to expect an overall gain in the vicinity of 100. The overall gain of a two stage amplifier (no emitter follower for isolation) may also be computed to be between 9 and 22.

The author has constructed the circuit of Fig. 7 (with and without emitter follower isolation). The resulting dc voltages (not signal applied) are shown near the corresponding transistor elements on Fig. 7. Notice that they are very close to the predicted values with one exception. The emitter of the emitter follower is apparently more positive than the base. This cannot be. The error is due to reading the base voltage with a 20,000 ohms/volt meter. A VTVM should be used.

AC gain measurements were made using an audio oscillator at 1 kc as the signal source. In each case the input level was adjusted so that the output waveform just began to clip. For the first stage alone 18 volts peak to peak was obtained with an input signal of 1.85 volts (p-p), giving a gain of 9.72. The second stage came out almost as nice, yielding maximum output voltage of 17.0 volts (p-p) for an input of 1.80 volts (p-p). This corresponds to a gain of 9.46.

The two stage amplifier without the emitter follower gave a gain of 9.89. With the emitter follower included a gain of 91 was obtained for 15 volts (p-p) output and 0.170 volts (p-p) input.

You will notice, of course, that we could not predict the exact gain of the composite amplifier. Please take note of the fact that we did come close, though.

That about wraps it up. The author makes no claim for having originated this design procedure. It is fairly common knowledge among circuit design engineers but it is not often seen in print. Usually techniques of this type are passed along by word of mouth. The author learned the procedure while working on his Masters thesis at Oklahoma State University and owes much to the faculty and his friends at that school.

The techniques described in here are really only the beginning of a far reaching design technique but much can be learned by applying them. May you find them very useful.

. . . K2HQY

All transistors 2N1302
Voltages shown are measured dc values—no signal applied, taken with a 20,000 ohm/volt dc voltmeter.

REFERENCES

Transistor Circuit Design; Texas Instruments Incorporated McGraw-Hill, 1963, Chapter 7 and 8.
Transistor Circuit Analysis; Joyce and Clark, Addison-Wesley, 1961.

Letter

Dear Wayne:

Would like you to print in either "73" or "6 Up" magazine, the fact that the East Coast VHF SSB Association is still offering a trophy for the first Ham to work 48 states on 6-meter single sideband.

The present band opening season, now in effect, has reawakened considerable interest among the sideband operators. A good number of the "rare" states are being heard.

No award like this has ever made, and we think it would be an honor to the Ham who can win it.

We now have a call list of 267 Sidebanders in the New York to Washington, D. C. area, and we are certain there are 75 more operators, whose calls we have not marked on our list.

Abraham Z. Cutler, WA2ONB
Secretary-Treasurer

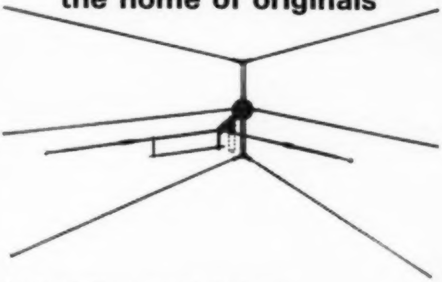
SENSATIONAL!!

COVĒYA-6

The first 6 meter beam in this configuration. A cardioid pattern without side nulls. Perfect for round table QSO.

by NEW-TRONICS

the home of originals



Look at these great features:

- 10DB gain over ½ wave dipole
- 25DB front to back ratio
- VSWR at resonance: 1.1 to 1
- Band width — 1000 KC with VSWR under 2 to 1
- Gamma matched
- 52 ohm coax feed line
- Adjustable for center frequency, 50 to 54 mc.
- Power capacity — 1 KW.
- Made entirely of seamless heat treated aluminum tubing
- Aluminum castings and hardware are iridited
- Weight 8½ lbs.
- Boom length 34"
- Turning radius 55"

Model COV-6............................$39.90

See this sensationally new 6 meter beam at your distributor or write for literature.

NEW-TRONICS CORPORATION
"the home of originals"
3455 Vega Ave., Cleveland, Ohio 44113

CLOSE OUT ON THE FOLLOWING KITS

Limited supply. Don't delay.

TRANSISTOR POWER SUPPLY. April 63. W1ISI	$22.50
QRP TRANSMITTER. March 63. W1MEL	$5.00
SW CONVERTER FOR HAM RECEIVER. August 62. W2LLZ	$11.00
RECEIVER DECEIVER. January 64. W2RWJ	$15.00
SIX METER CONVERTER. May 63 No xtal. WA2HVK	$15.00
QRP KILOWATT. March 63. WA4DQS	$5.00
CAST IRON BALUN. September 63. W4WKM	$3.00
NUVISTOR PREAMP FOR 15-20 METERS. April 63. W6SFM-1	$4.00
CW NOISE LIMITER. September 63. W6SFM-2	$3.00
PORTABLE 40M TRANSMITTER. March 63. K6LJY-1	$22.50
PORTABLE 40M RECEIVER. March 63. K6LJY-2	$15.00
TWO METER ANTENNA COUPLER-SWR BRIDGE. July 63. W6TKA-1	$9.50
BOURBON S-METER. September 63. W6TKA-2	$6.00
TONE MODULATED XTAL STANDARD. October 62. W9DUT-3	$12.00
NOISE GENERATOR. April 63. Thomas	$9.00
COIL EVALUATOR. June 63. W0QWY	$8.00
40w TRANSISTOR MODULATOR. September 62. VE7QL	$25.00
NOISE GENERATOR. Invaluable test instrument for tuning up rf stages, converters, etc., voltage regulated by a ener diode. Kit includes even the battery and mini-box. K9ONT	$5.00
TRANSISTOR TRANSCEIVER. One of the most popular kits we've ever assembled is this six meter miniscule transistorized transceiver. Really works. Hundreds built. See page 8 in the May '63 issue. Five transistors. K3NHI	$25.00
TWOER MODIFICATION. Increase your selectivity considerably by installing a new triode 7587 nuvistor stage. This is our best selling kit to date. Everything you need for the modification is included. See June '63 page 56 K6JCN	$7.50
CW MONITOR. Connects right across your key and gives you a tone for monitoring your bug. Page 44, June '63. WA2WFW	$4.25

73 Inc.

Peterborough, N. H.

Transistors for Ham Use

Paul Franson WA4HWH/WA1CCH

When the ham decides to build some transistorized equipment, he has two choices ahead of him. He can copy someone else's work (such as articles in this issue) or he can try to design his own. The ham magazines have had many helpful articles and various books and handbooks will also prove invaluable, but in the choice of transistors the ham reaches a stumbling block. There are an incredible number of semiconductors available—So which one to use? The transistors listed are suitable for most ham communications uses. We recommend that you pick a transistor for each application and concentrate on these transistors. Then you'll learn the characteristics and possibilities of the transistors thoroughly and keep your stock (and expense) down.

In case it sometimes seems that many semiconductor manufacturers are not interested in hams and their equipment, remember that the big money is in government and industrial applications. Don't judge the manufacturer too harshly. However, all the semiconductors listed are made by manufacturers who have shown interest in amateurs; we heartily recommend that you use their products. Remember that most transistors now made are designed for switching and other computer applications, but notice that Amperex makes a complete line of high quality communications transistors at very moderate prices. Motorola, T.I. and others likewise.

One other hint—Newark Electronics in Chicago is one of the few mail order distributors that issues a combined industrial-amateur catalog. Many of these transistors are listed only in industrial catalogs, so it is recommended that you get the Newark catalog. They carry all of the semiconductors listed. Be sure to mention 73 when you write.

Application Notes

The following list of transistor application notes are of particular interest to hams. These booklets are generally fairly technical and

(Text continues on page 64)

Trans	Mfg	Price	Case	V_{CB}	$I_C$ma	$P_C$mw	$h_{fe}(h_{FE})$	$f_T(f_{hfb})$	Gain in db @ f	Remarks
UHF AMPLIFIERS AND MIXERS										
2N1742	Sp	2.93	TO-9	20	50	60	(33)		14-19 @ 200mc	f max 980 mc NF5.5db
2N2360	Sp	2.40	TO-12	20	50	60	(33)		ditto	ditto
2N2495	Am	2.36	TO-33	35	10	100	70	(180)	15.5 @ 200mc	4 db NF @ 200mc
2N3283	Mot	2.10	TO-18	25		100	(10)	400	20 @ 200mc	4 db NF @ 200mc
162T1	GE	1.36		14		80	(15)	360	18 @ 200mc	5 db NF @ 200mc
TI-390	TI	2.04	TO-12	30	25	75	(10)	450	12 @ 100mc	NF 2.5db at 200mc
2N1743	Sp	2.87	TO-9	20	50	60	(33)		14 @ 200mc(conv)	Mixer
2N2361	Sp	2.25	TO-9	20	50	60	(33)		ditto	ditto
2N3284	Mot	2.02	TO-18	25		100	(10)	400	20 @ 200mc	Mixer
TI-391	TI	1.85	TO-12	30	25	75	(10)	450		Mixer
UHF OSCILLATORS (Note that all of the amplifiers and mixers may also be used)										
2N502	Sp	2.90	TO-1	20	100	60	65		8 @ 200mc	Gen Purpose f max 500
2N1744	Sp	2.25	TO-9	20	50	60	65			1.5mw out at 257mc
2N2362	Sp	2.10	TO-12	20	50	60	65			like 2N1744
2N3285	Mot	1.80	TO-18	20		100	(10)	400		osc to 2000mc (f max)
2N3293	Mot	1.80	TO-18	20		200	(10)	600		NPN Silicon f max 2000
VHF AMPLIFIERS (Note that all the above transistors will work even better at VHF than at HF)')										
2N2084	Am	1.34	TO-33	40	10	125	100	(100)	14 @ 100mc	"Universal RF trans."
2N2671	Am	.84	TO-12	32	10	100	150	(100)	14 @ 100mc	
160T1	GE	1.18		14		80	(15)	345	G_p 25 @ 100mc	f max 1000
HF AMPLIFIERS, MIXERS AND OSCILLATORS (VHF and UHF transistors may also be used)										
2N1745	Sp	1.81	TO-9	20	60	50	(33)		21 @ 45mc	f max 500
2N2189	TI	1.64		40		125	135	(150)		
159T1	GE	1.14		14		80	(15)	330		
TI-365	TI	1.50		30	50	150	(30)			RF amp
TI-395	TI	1.41		30	50	150	(30)			Oscillator
10.7 mc IF										
2N1865	Sp	1.10	TO-9	20	50	(60)			25-31 @ 10.7mc	
2N2654	Am	1.42	TO-12	32	10	100	50	(250)	19 @ 100mc	
155T1	GE	.62		12		80	(20)	150	G_p 35 @ 10.7	
BC AMPLIFIERS, MIXERS, OSCILLATORS AND IF'S										
2N1726	Sp	1.15	TO-9	20	50	60	(40)		35 @ 1.6mc	RF amp f max 100
2N1727	Sp	1.00	TO-9	20	50	60	(15)		35 @ 1.6mc	Mixer f max 100
2N1728	Sp	1.10	TO-9	20	50	60	(25)		40 @ .455mc	Oscillator-if amp
2N2672	Am	.67	TO-39	32	10	100	150	(75)	8 @ 100mc	
TI-364	TI	.78		30	50	150	(20)			
LOW LEVEL AUDIO										
2N1274	TI	.69	TO-5	25	150	150	(30-150)			
2N2428	Am	.56	TO-1	32	100	500	130	1.7		high gain
2N2429	Am	.57	TO-1	32	100	500	220	2.3		very high gain
2N2431	Am	.57	TO-1	32	300	360	63			NPN
HIGH LEVEL AUDIO										
2N456B	TI	2.50	TO-3	40	7 A	150 W	(30)			
2N555	Mot	.75	TO-3	30		40W	50			
2N1038	TI	2.85	TO-3	60	3 A	20 W	(20)			
2N2431	Am	.62	TO-1	32	1000	1000	90			
TRANSMITTER OSCILLATORS AND AMPLIFIERS										
PADT50	Am	5.00	TO-3	70	700	6W	40	120		
2N741	Mot	2.18		15		150	(10)	360	22 @ 30mc	
2N2084	Am	1.34	TO-33	40	10	125	100	(100)	14 @ 100mc	
2N2512	Am	1.50	TO-33	70	50	260	200	175		
2N2786	Am	4.65	TO-39	34	150	1000	80	350	10 @ 80mc	.57watts out at 80mc
2N2957	Mot	4.50	TO-5	60		3000		400	NPN Silicon	.6 watts out at 50mc

GENERAL PURPOSE VARACTOR

1N3182 Am .82 solder-in P_o 163 mw VR 20 v C @ -4 v: 33mmf Q @ 50 mc: 65

TUNNEL DIODES

1N3716	GE	2.55	I_p 4.7ma	V_p 65mv	-G 40 x 10^{-3}mho	TD-3
1N3718	GE	2.55	I_p 10.0ma	V_p 65mv	-G 80 x 10^{-3}mho	TD-4
1N3720	GE	1.80	I_p 22.0ma	V_p 65mv	-G 180 x 10^{-3}mho	TD-5

Am: Amperex; GE: General Electric; Mot: Motorola; Sp: Sprague; TI: Texas Instruments most do not give specific circuit information on coils and layout. Magazine articles and handbooks will provide more information useful to the beginner. Nevertheless the notes are very informative and of great help to the serious experimenter. However they are very expensive for the manufacturer to produce. Study the handbooks before you send for them and be sure to mention 73 when you write—but don't kill the golden goose by requesting information that is not useful to you.

John Miller, Tech Publications Manager
Texas Instruments
Semiconductor Building
13500 North Central Expressway
Dallas, Texas

VHF transistor power stages
200 mc noise figure measurement
Transistors in UHF-TV tuners
Amateur communications receiver

Sidney Chertok, Manager, Advertising and Sales Promotion
Sprague Products Company
North Adams, Massachusetts

Short form catalog CN-116F
2N1742, 3, 4 and 2N2360, 1, 2, in VHF amplifiers and mixers. 38,020.
45 mc if amplifier using 2N1745 and 2N1868. 38,021.
MADT transistors in AM radio applications. 38,018.
MADT transistors in 4.5 and 10.7 mc if amplifiers (also includes a simple all-wave communications receiver). 38,022.

Rarrell Thorpe, Tech Communications Supervisor
Motorola, Inc.
P.O. Box 955
Phoenix, Arizona

Modulation techniques for transistorized AM transmitter. Report 82
50 mc transmitter using the 2N2947. Report 99.
2 watt output at 160 mc using the 2N2950. Report 100.
CB transmitter using the 2N2950. Report 101.
2N741 as a power oscillator and class C amplifier. AN 124.

M. Smoller, Manager, Advertising and Sales Promotion
Amperex Electronic Corporation
230 Duffy Avenue
Hicksville, L. I., N. Y.

Condensed catalog (Includes some circuit diagrams)
2N2495 in mixer at 170 mc. S-103
(465 mc) receiver using the 2N2495 and 2N2084. UHF S-105
FM tuner using 2N2089 (2N2671) and 2N2495. S-106
10.7 mc if strip and ratio detector. S-110
VHF power amplifiers at 200 mc using the 2N2786. S-113
Low noise 200 mc rf amplifiers using the 2N2495. S-114
Power output of parallel 2N2786 at 235 mc. S-115

The Amperex notes are unique in giving very complete information on coils. They even give layout in a few cases; for instance, S-110 tells you how to wind your own 10.7 mc if coils and S-105 gives information on a cavity filter for the front end.

Say! You saw it in 73

Modifying the Vanguard Transmitter and Converter

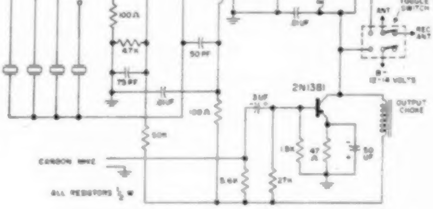
To those who have not purchased a Vanguard 6M transmitter and converter: they don't know what they are missing. See their ads in any old 73.

The transmitter is a 50.5 xtal oscillator using a 2N2671 transistor feeding a final, using another 2N2671 collector (plate to those who compare transistors to tubes) modulated.

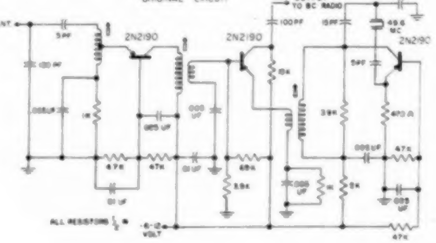
We had a Texas Inst. 2N1143 transistor which we stuck in the final and guess what? We about doubled our rf output, but the modulation was down. We added another stage using a 2N188 and the modulation was good. There isn't enough gain for a xtal mike with the present circuit. A 2N107 and a CK722 was tried but they were a little mushy with the circuit used.

A small 6 transistor radio was obtained (the little Jap jobs about the size of a cigarette package can now be bought very cheap at sales or as damaged goods at the retail stores. I bought ten for 50 cents each). A small break in the printed circuitry or a loose part was all that was wrong. I took the set out of the case and mounted the radio, converter and transmitter plus 8 flashlight bat-

VANGUARD 6M TRANSMITTER
ORIGINAL CIRCUIT


XTAL SELECTOR
2N2671
2N2671
20PF
100Ω
47K
75PF
.01UF
50PF
100Ω
50K
.01UF
75PF
20 PF
DPDT TOGGLE SWITCH
ANT
REC ANT
B-
12-14 VOLTS
2N1381
3UF
OUTPUT CHOKE
18K
47 Ω
50 UF
5.6K
27K
CARBON MIKE
ALL RESISTORS ½ W

VANGUARD 6M CONVERTER
ORIGINAL CIRCUIT


ANT
5PF
100PF
2N2190
2N2190
2N2190
OUTPUT TO BC RADIO
100PF
15PF
50PF
49.6 MC
5PF
.005UF
1K
.005 UF
.005 UF
10K
3.9K
470Ω
47K
47K
.01UF
68K
3.9K
.005UF
47K
.01 UF
.005 UF
1K
5K
.005 UF
ALL RESISTORS ½ W
-6-12 VOLT
47K

W. G. Eslick KØVQY
2607 E. 13th.
Wichita 14, Kan.

teries size C, a mike jack and an on/off switch in a metal case that was in the junkbox. I mounted a handle on the case to carry it. A coax connector was mounted on top for outside antenna or whip.

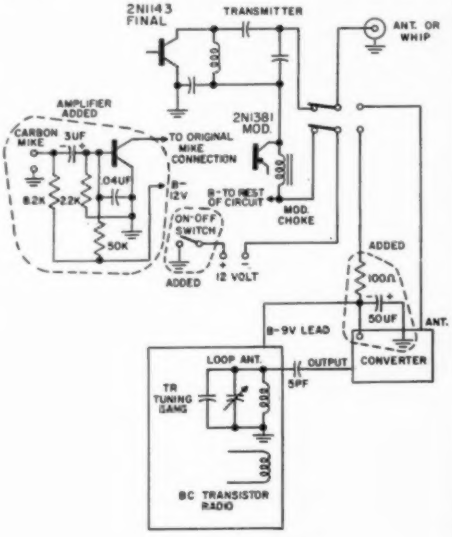
A decoupling and voltage dropping resistor of 100 ohm by-passed with a 50 mfd 15V condenser supplies the converter/receiver with slightly over 8 volts.

The Vanguard transmitter comes with 4 xtal sockets and a selector switch (4 channels) and an on/off-xmitt-rec. switch. I removed all xtal sockets but one, and the selector switch, as they were not used.

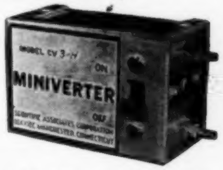
They recommend wrapping a few turns around the loop antenna of a bc radio, grounding one end and connecting the converter to the other. I had the best luck of connecting a 5 mmfd from transistor mixer collector to the antenna side of the tuning condenser in the bc set.

Being mounted inside of a metal case, I had only two feedthru bc stations, one high powered local and the other local about three miles east of QTH.

In all, I am very well pleased with Vanguard's little gems. Need a linear now!!!


2N1143
FINAL
TRANSMITTER
ANT. OR WHIP
AMPLIFIER ADDED
CARBON MIKE
3UF
TO ORIGINAL MIKE CONNECTION
.04UF
B- 12V
8.2K
22K
50K
2N1381 MOD.
B- TO REST OF CIRCUIT
MOD. CHOKE
ON-OFF SWITCH
ADDED
+ 12 VOLT -
ADDED
100Ω
50UF
ANT.
B-9V LEAD
LOOP ANT.
OUTPUT
5PF
CONVERTER
TR TUNING GANG
BC TRANSISTOR RADIO

MODIFICATIONS


MODEL CV 3-
ON
MINIVERTER
OFF
SCIENTIFIC ASSOCIATES CORPORATION
MANCHESTER CONNECTICUT

MINIVERTER

CONVERTS ANY RADIO TO A SENSITIVE SHORTWAVE RECEIVER

★ Crystal Controlled Units Available from 2 to 150 MC.

★ Input Either High Impedance (BC Whip) or Low Impedance (Tuned Whip)

★★★ NOW ★★★

★ **ALL** Units Transistorized with RF stage and tuned mixer.

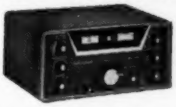
★ The following models are available with either high or low impedance inputs (Please specify desired impedance when ordering):

CVA2(160M); CVA4(80M); CVA7(40M-CHU); each $14.95
CV14(20M); CV21(15M); CV29(10M); CV30(10M); CV50(6M); each $24.95
MARS Models: 4 to 5 MC (BNC Connectors) 14 to 15 MC output, MARK I $18.95
4 to 5 MC (BNC Connectors) 6.8 to 7.8 MC output, MARK II $18.95
CAP Models: 4 to 5 MC (auto radio) .5 to 1.6 MC output $18.95
FIRE, POLICE: 30 to 50 MC (any 1MC segment) ... each $27.95
MARINE: 2 to 3 M (auto or home radio) .... each $18.95

★ Brochure available upon request

★ Order direct from

SCIENTIFIC ASSOCIATES CORPORATION
BOX 1027, MANCHESTER, CONNECTICUT



"*Your Friendly Supplier*"

OFFERS

THE *hallicrafters*
SR-160 TRANSCEIVER

GO MOBILE! or for Fixed Station. The SR-160 is a Tri-Band filter type transceiver for operation on 20, 40, & 80 meter SSB or CW. Conservatively rated at 150 watt P.E.P. input.

SR-160 Transceiver	$349.50 NET
P-150DC 12 Volt Supply	109.50 NET
P-150AC AC Supply/Speaker	99.50 NET
MR-160 Mobile Install. Kit	14.95 NET

ALSO IN STOCK: Hallicrafters SR-150 Transceiver 5-Band operation 80 thru 10 meters SSB/CW $650.00

Power Supplies for SR-150—Same as above.

MR-150 Mobile Mount for SR-150 $39.95 NET

"Used Equipment August Special"

HALLICRAFTERS SX-101A	$274.95
HALLICRAFTERS HT-37	$360.00

WRITE FOR LATEST COMPLETE LIST

Evans RADIO

P.O. BOX 312
FONE 603-225-3358
CONCORD, N. H.

Charles Leedham WA2TDH

The Heath SB-300 Receiver

One of the first things that is bound to hit any ham looking at Heath's new SB-300 is the fact that it looks startlingly like another well known receiver which shall here be known, in the manner of certain sneaky TV commercials, as "Brand C." At least in the black-and-white catalog and pictures it does. In living color, things are slightly different, what with a dark green front panel. Question: does it do more than just look like the high-priced spread? Does it work like Brand C? Answer: as far as my ear and limited supply of test equipment can tell, it does.

In short, Heath has come out with a fair wowser of a ham receiver at the relatively modest figure of $265. It not only works good like a ham receiver should, but a few extra bits of good thinking have been thrown in. The only thing I'm not at all sure of is why the Benton Harbor gentlemen made it look so very much like—and there let us abandon all subterfuge—the Collins line. Perhaps this is the best of all possible ways for a ham receiver to look—I tend to agree with this sort of thinking. Or perhaps Heath was boldly inviting comparison. If so, they didn't do wrong, for the comparison by no means hurts them.

To the necessary formalities first, however. The SB-300 is a full-coverage receiver, designed primarily for SSB, with CW and AM as is, or even better if you add filters for each mode at $20 per. It tunes eight 500 kc band segments, into which the amateur bands fall with a good many kc left over here and there: 3.5-4, 7-7.5, 14-14.5, 21-21.5 and 28-30 megacycles.

One of the very good features of the SB-300 is the fantastic bandspread. One complete turn of the circular main dial is worth 100 kc, and it takes five turns of this dial to work your way across the half-megacycle of band provided in each of the band positions. With the main dial 12 inches around, this works out to five feet of bandspread per half-megacycle. Imagine a linear dial covering 80 meters, with the pointer moving along a five-foot-long scale between 3.5 and 4.0, and you get something of an idea of how finely and accurately the SB-300 can be tuned for SSB and CW.

As the main dial goes around, an ingenious spiral mechanism inside moves a pointer across an upper scale, thus enabling you to keep track of where you are in the band. The actual tuning knob is verniered, with 4¼ turns per 100 kc—thus you can really zero in on a signal, even if you're as ham-handed as I am. It needs no delicate jiggery and pokery to do fine tuning on the SB-300.

Along with this wide bandspread goes Heath's inear Master Oscillator, a precision bit of business that means just what it says—linear. The specs claim electrical dial accuracy of 400 cycles from one end to the other, on any band. As nearly as I can tell, it is that good or better. Once you have calibrated the dial against the built-in crystal calibrator, this means that when you tune to a spot, you are there, or so close as makes no difference. No more trying to remember which spots on your dial mean approximately what they say—ask someone to meet you on a given frequency, tune the receiver to that spot and, if his transmitter is as accurate, there he comes, right at the setting. If another operator asks you to listen for him 5 kc higher, you move the dial up five notches, and you are positively

5 kc higher. This is the kind of operating ease you get with first-class equipment.

Back to the essentials: the SB-300 has an all-crystal front end, variable ACG control, a very high frequency *if* (3395 kc) for good image rejection, excellent sensitivity—the specs say less than one microvolt for 15 db S + N/N ratio, and it tests out at about that.

Construction of the kit is basically straightforward and easy, although it takes time. The LMO is pre-built and sealed, taking that job off your hands and assuring factory-aligned accuracy. All you do is bolt it in place and solder on a few leads. Also the pass band filter, and the *if* filter or filters. Most of the work is done on two circuit boards, the rf and *if* sections.. It is no cinch, for there are are an unbelievable number of resistors and capacitors to be put into the boards, but everything goes step by step. Total construction time is on the order of 40 hours if you're experienced at doing kits; probably about 10 hours more if you're not. In any case, you've got a good week of evening work cut out for you, going at it fairly steadily. After the parts are all in place, there is a pre-cut cabled wiring harness for making the major hook-ups from section to section, which removes a great deal of the pain of construction.

When tune-up time finally comes, everything is made easy and precise by tuning against the 100 kc crystal calibrator. All the tunable coils are gathered in one handy spot and—here another good idea—the whole top of the cabinet lifts up and back on a piano hinge, giving you easy and immediate access to the coils. Also, to find out where you soldered things wrong that are making the fuses blow, the whole chassis slips right out of the cabinet with the loosening of only a screw or two, thus saving you much sweating and cursing.

In operation, the SB-300 is a top-notch receiver. The 2.1 kc crystal filter for SSB gives good sharp characteristics, and with that long. long bandspread SSB is remarkably easy to tune. Frequency stability is very good, less than 100 cycles claimed in the specs, and easily that good in practice. Also, even with the wild fluctuations made by the voltage here in Manhattan, the frequency stays remarkably stable.

Because the SB-300 is a very specialized receiver, nothing happens when you turn the mode switch to CW or AM, unless you have popped for the extra crystal filters for those nodes—a 400-cycle unit for CW and a 3.74 kc for AM. You can, of course, tune CW in the SSB position and also AM. Still, it was a

NEW callbook

HOT OFF THE PRESS!

Over 60% of listings changed in only a year!

PLUS THESE EXTRA FEATURES:

- Great Circle Bearings
- Great Circle Charts
- Prefixes by Countries
- "Q" and "Z" Signals
- World Time Chart
- Int'l. Postal Rates

United States Listings...$5.00
DX Listings............... 3.00

ORDER THESE USEFUL AMATEUR RADIO AIDS TODAY!

Radio Amateur DX Guide—62 pages of vital data; 291 Great Circle Bearings for 22 major U.S. cities; Prefix Map, Time Conversion Table, DX Log, plus other features .... postpaid $2.00

World Prefix Map—Full color, 29" x 42", shows prefixes on each country . . . DX zones, time zones, cities, cross referenced tables .... postpaid $1.00

World Atlas—Only Atlas compiled for amateurs. Polar projection, six continents, prefixes on each country . . . full color, 16 pages .... postpaid $1.00

WRITE FOR FREE BROCHURE!

RADIO AMATEUR callbook INC.
Dept. B, 4844 W. Fullerton Ave.
Chicago, Ill. 60639

See your favorite dealer or order direct (add 25¢ for mailing)

revelation to me to listen to CW with the proper filter installed. There is the usual hollow, ringing sound of such a narrow filter, but once a CW signal is centered in that filter, there it is, with no nonsense about it. It sounds like suddenly everybody else went off the air. That knod of filter requires the stability that comes with the SB-300, and to anyone—like me—accustomed to trying to copy CW while the note wobbled and other nearby stations faded in and out and made everything miserable, it was startling to be able to catch a signal, and then sit back to copy it with ease.

Only the AM filter seems relatively useless. AM comes in very nicely with it, but it is of little consequence when you can also tune AM just as well in either of the SBB mode positions. About the only thing it does is enable you to listen to Radio Moscow more clearly as it smears the 40-meter band. It also seems futile to have a specialized AM filter when Heath's companion transmitter the SB-400, has no provisions for AM transmission.

The SB-300 is naturally intended for use with the SB-400 transmitter (just out recently, at $325 for an all-band 180 PEP rig), and it is possible to arrange your inter-unit wiring to make one oscillator work for both receive and transmit, thus working transceive with dead-on accuracy. Or you can operate them separately for DX work. The SB-300 works, of course, as well with any other transmitter, except for the transceive feature. There is also provision for operating the SB-300 with two VHF converters, permanently hooked up and switchable-to without a lot of hooking and unhooking. An auxiliary power plug supplies juice to the converters and the converter outputs feed right into the back of the receiver, into special sockets.

All in all, the SB-300 is a very good rig, more than worth the money if you want to do serious receiving.

. . . WA2TDH

Is it Time for a Change?

A. David Middelton, W7ZC/W5CA
Associate Editor
The Monitor
Box 303 Springdale, Utah 84767

Reprinted from June 1964 *Monitor*

In this long hot summer of 1964 the nation is plagued not only with national and state elections but due to ARRL's inept policy—the ARRL elections for Director and Vice Director must be held in eight divisions.

ARRL By-law 18 states that half the divisions shall elect officers each year. This article refers to "Director" only but election rules include Vice Director also. Altho he is an elected official, an ARRL Vice Director is a political non-entity and because ARRL will not permit any voice in the conduct of ARRL affairs, he is as useless as a fifth wheel!

This year the following divisions will hold elections. Incumbents are named along with their divisions.

Central (Haller—replaced Doyle in mid-term 1963); Hudson (Kahn—elected in 1958. He stated at 1964 Board meeting he would not run this fall as he is moving to Florida. This writer will lay odds that Kahn will show up as a candidate from SE Division in a future go-around.) New England (Chaffee—elected prior to 1957); Northwestern (Roberts—elected in 1948); Roanoke (Anderson—elected prior to 1957); Rocky Mountain (Smith—elected in 1960); Southwestern (Meyers—elected in 1958); and West Gulf (Best—elected in 1960). Each of these men took office on Jan. 1st of the year following election except Haller who replaced Doyle in mid-term.

Regardless of the inanity of ARRL's policy of electing officers for a two-year term, every ARRL member owes it to himself, if to no other reason, to select and elect qualified parties to the Directorship.

By-law 13 states that on any date not later than noon of the 20th day of September of an election year in any electing division, nominating petitions signed by TEN or more FULL members of a division, and naming a FULL member of the division as candidate for Director (and Vice Director) may be filed with the Secretary. Petitions are also solicited by notices placed in August and September QSTs.

Far too often an incumbent is returned to office, by default, without ballotting due to one or several "incidents."

His name may be the only one submitted.

If no petition is filed, the request for petitions is repeated three months later, and then if no nominee is named the incumbent returns to office until the next regular election for that division.

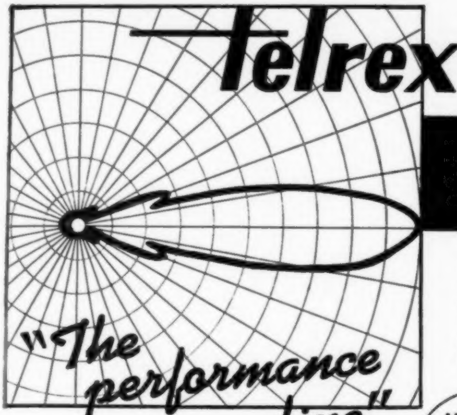
Candidates named in petitions may be declared "ineligible" by the ubiquitous Executive Committee. Ineligibility may be ruled due to a candidate not having the required four years membership in ARRL (altho Article 12 does not state when this four-year period is dated). A candidate may be ruled ineligible due to his vocation (Article 12 again) or he may not have a General Class (or higher) license (By-law 8).

The following inconsistency is noted. Petitions are receivable until noon Sept. 20th. By-law 14 states that the Executive Committee shall delete the name of any nominee—who may be ineligible, and the name of any who may withdraw by written communication. By-law 14 does not state WHEN such action by the Executive Committee shall be taken. It is therefore assumed that it occurs AFTER noon, Sept. 20th, which makes it impossible for a group of ARRL members to submit another petition to replace that of an "ineligible" person!

Also, no procedure is defined where anyone can challenge the ruling of the Executive Committee on this important matter. So—in the case of an "ineligible" candidate—he is OUT, unless he wishes to take it to court. Only one party did this. Some time ago a court suit was filed, hearings held (of all places, in Hartford) and the court ruled against Candidate JOHN from Maryland or Virginia.

One type to avoid is a candidate who will permit his name to be entered in nomination, and after it is too late to do anything about it—follows the dictates of the Pressure Group and withdraws his name from nomination. This is a common trick used to confuse and defeat any group seeking to replace an incumbent by another director. Often it serves to return the incumbent, sans vote by the membership!

By-law 14 further states that if there be more than one eligible nominee, the Secretary shall send by mail (during the first week in October) a ballot to each FULL



with a
MATERIAL DIFFERENCE
—IN USE IN 135 LANDS!

"BEAMED-POWER" ANTENNAS
and ANTENNA SYSTEMS

The Choice of the Discriminating
Communication Engineer . . . the
Man who Never Settles for Any-
thing Less than THE-VERY-BEST!

You too—can enjoy world renowned TELREX performance and value! Send for PL65 condensed data and pricing catalog, describing the lowest priced antennas on the market, in relation to materials and performance! Expanded data sheets—including your favorite band, are also available.

ANTENNAS SINCE 1921 telrex COMMUNICATION SYSTEMS LABORATORIES
ASBURY PARK 25, NEW JERSEY, U.S.A.

member (holder of any valid Amateur license) of record as of Sept. 20th. However, due to the poorly-managed mechanics of ARRL, whereby membership and subscription to QST are tied together many drawers of Addressograph plates are "out for processing" at any given time, and therefore a sizable percentage of FULL members do not receive a ballot.

NOTE—if you are a full member of a voting division and do NOT receive your ballot by October 15th you should request one, in writing from the Secretary. Or else you will lose your only opportunity to vote, and must then wait two years for the next.

Ballots are returned to HQ and must be received there by Noon, Nov. 20th. Sometime after that date and time, the count of ballots is held and the election completed.

Here are the steps, in chronological order, that must be taken to replace an incumbent or to fill a vacancy with a new director.

1. Seek and find a politically-qualified person willing to seek the office and to SERVE as Director (or Vice Director).
2. Ascertain his views, on past and present ARRL problems and all matters pertaining to Amateur Radio. His opinions should be obtainable in writing!
3. Certify by examination of records that he has been a FULL member of ARRL for at least FOUR consecutive (unbroken) years and that his ARRL membership is valid at least until January 2nd of the next year. Examine his membership certificates or write to the Secretary (who will refer the matter to the QST Circulation department) for verification and certification.
4. Ascertain thru his records that he holds at least a GENERAL class license valid thru Jan. 2nd of the next year.
5. Prepare and circulate for signature, a petition bearing the legible names and addresses and calls of at least TEN FULL members of ARRL, whose subscription-membership dates are valid at least until November 20th of that year.
6. Mail this petition, via registered or certified mail, with return receipt requested, so that it will reach ARRL HQ at Newington, Conn. well *before* noon, Sept. 20th. Petitions can be mailed anytime now. A deadline for mailing should be set at not later than SEPT 10th!
7. For further insurance, have prepared another petition, with the same name for candidates, but with a completely different set of FULL ARRL member signers. The presence of the same signature on two petitions would automatically invalidate BOTH petitions.

Take every precaution to have at least TEN signa-

Reyco Multiband Antenna Coils
Traps for dipoles . . . high strength . . . moisture proof guaranteed to handle a full KW.
Model KW-40 coils will, with a 108 foot antenna, provide operation on 10-15-20-40-80. **$12.50 set.**
For information on other models write:
FRED L. REYNOLDS W2VS, 492 Ravenswood Ave., Rochester 19, New York

VHF-UHF
Converters & Preamps.
50 thru 432 Mc.
Write for literature
Parks Electronics, Rt. 2, Beaverton, Ore.

WANTED *WANTED*
R-390A/URR
RECEIVERS
Any quantity, any condition
Top prices paid. Call collect
Space Electronics
4178 Park Ave, Bx, N. Y., CY 9-0300

GUARANTEED RECONDITIONED
HAM GEAR
Amrad
ELECTRONICS
WRITE NOW FOR MONTHLY FLYER.
Phone: (415) DI 2-5757
999 HOWARD AVE-BURLINGAME, CAL.

tures. A minimum of 12 or 15 is a safe-guard. QST-readers who are NOT full members are NOT legally acceptable.

This writer would like to make it perfectly clear that the ARRL policy-makers and power-political clique will take every opportunity to confuse, to declare ineligible, and to defeat ANY candidate who seeks to un-seat a "desirable" director who is in favor. Any candidate who appears to be a non-conformist to the ARRL Party Line or who might become a factor opposing their schemes will likewise get the full treatment in an attempt to knock him off before he can become a threat to their plans!

Not only must the written rules be observed but every effort must be made by any group seeking to enter a candidate to counteract the unpredictable and unrefutable actions of the and unassailable actions of the Executive Committee in its rulings on eligibility!

The worst act is to permit an inept and bungling incumbent to be returned to office without voting by the membership, by not filing a petition for a candidate to oppose him!

The second worst act might be to present a candidate who will not permit his name to be placed in nomination or who is ineligible, according to the written rules, as confusing as they may seem!

A genuine sin is to return a director who has *proved* his ineffectualness thru his reactionary thinking, lack of action and his indifference to the wishes of his divisional members regarding national ARRL policy or matters pertaining to Amateur Radio in general.

Sentiment or longevity in service has NO place in the selection of an ARRL official, unless such devotion is due to this officer having rendered the *highest possible service to the Amateur body!*

If you wish to determine and to know the actual views or actions of any incumbent, read and study the minutes of the past Board or Committee meetings on which he has served. Board minutes appear in July issue of QST, each year. These minutes are the only *direct* reflection of the incumbents views and actions that he took or did not take during the past year or years he has been in office! He stands or falls on his record—at the Board meeting!

As to the political promises of a candidate seeking the Directorship, that is a far different matter. One should make every effort to determine a candidate's views, in writing, on problems and programs affecting Amateur Radio particularly at the national policy level.

Is the candidate known for his militant acts, thoughts and statements concerning issues of importance or is he merely seeking a couple of free rides to HQ?

Will the candidate, if elected, follow the dictates of his membership and faithfully report on his action and on matters of general interest or will he ignore his constituents after he is elected.

The time to determine all this is BEFORE he is elected. After Jan. 1st of the next year, when he takes office he can and often does simply ignore the rank and file and throw his weight around as a Director without actually ever *doing* anything. This writer refers you to his thought-provoking article in May 1964 *Monitor* entitled "To Act is to Be Committed," an analysis of the 1964 ARRL Board meeting.

Such decisions are necessarily made by each individual ARRL member and thought should be given NOW to the desirability of a change in *your* division. By the time this is in print, less than 60 days will be left in which to place a name in nomination.

Study of the Board meetings of recent years will reveal the *overwhelming necessity to completely change the attitude and posture of the ARRL BOARD.*

This can be done in 1964's election! It is up to you. If you want a change—you can elect a man to *represent* you and your division, and thus, all of Amateur Radio. If you are *satisfied*—then you have read this article for naught.

The Q of an ARRL Director

Here are a few guide lines, which if followed, will give some indication of the Q (Figure of Merit) for either an incumbent or one seeking the office for the first time. These criteria hold for Vice Directors as well as for Director. While the Vice Director may never have an opportunity to DIRECT, he is a "back-up" man if the Director dies, resigns or is kicked out.

1. What does Mr. Candidate *really* think about Amateur Radio? Has he a genuine interest in the aims, goals and meaning of our hobby-service? Has he clearly demonstrated his interest by participating in various phases of Amateur Radio? Does he hold awards (other than for DX) certifying to his achievements?

2. What does Mr. C. really KNOW about Amateur Radio. What class licensee is he? (He must have at least a General to be eligible for office.) Often a person's genuine interest is shown by the amount of effort one makes to achieve personal peak-performance, without any external incentive. How far has Mr. C. gone to achieve an Extra Class, by examination? What are his views on "incentives?"

3. Is Mr. C. a push-button appliance-type operator; can he do no more than change a fuse in his equipment? Has he actually constructed equipment, from scratch? from kits? Has he a well-rounded technical background in Amateur Radio? Has he a working knowledge of the problems of SSB, VHF, CW, AM and antennas? His status as a licensee is indicative of his progress together with his experience as an Amateur.

4. Is Mr. C. a well-skilled operator? Handy with a key or mike? Can he handle traffic on either mode? Is he active on the air, at least an average of one hour a day? Does he take a modest interest in contests, enough to keep his hand and his ear in? Is he strictly a "roundtable" type operator or does he get in and dig out the station he wants thru the QRM?

5. Is Mr. C. thoroughly familiar with the background, aims and basic purposes of ARRL? Is he well informed of the manner in which ARRL has, and has not, faced up to current problems? the past situations? Is Mr. C. satisfied and content with the manner in which ARRL is being managed, controlled and with its current overall policy?

6. Is Mr. C. willing to openly state his opinions on controversial questions? Does he actually HAVE opinions? Will he back them up, in writing? Will he stand up and fight for his convictions when the time comes to be counted?

7. Is Mr. C. a person that can be swayed by pressure or by power-political groups who are acting against the best interest of Amateur Radio and the ARRL? Is he thoroughly honest? Can his vote or opinion be purchased? Will Mr. C. face issues squarely and sincerely with a desire to settle them in the highest basic ARRL concepts? Will he stand up for his ideals or will he fold up and keep silent when the chips are down?

8. Will Mr. C. ascertain the views of his constituents, prior to his voting on important issues? Will he stand by majority opinions and uphold your views, or will he, like so many, refuse to take polls, and refute their results even if he does take them?

9. Will Mr. C. demand that ARRL conduct member polls on important issues. Will Mr. C. refuse to be bypassed by ARRL HQ or the Executive Committee and will he actually be a DIRECTOR?

10. Will Mr. C. sit idly by while worthwhile legislation dies on the "table" or for lack of a second, or thru the political chicanery of pre-Board meeting sessions? Will he condone these "secret sessions" held to formulate and solidify these Board "14-1 or 15-1" votes?

11. Is Mr. C. a blind follower of the ARRL Party Line? Does he believe that their "policies" must be upheld, right or wrong, without question and without opposition from anyone?

12. Will Mr. C. faithfully report all important overtones, and deliberations of a Board, Executive or Working Committee so that members will KNOW the WHY behind decisions? Will he make such reports to you, in writing, minus the propaganda handed out by ARRL political power leaders.

13. Is Mr. C. a typical Amateur, and does he inspire others? Does he have a reputation for straight dealing, from the top of the deck, in all his works?

14. Is Mr. C. willing to seek and to take advantage of every opportunity to learn more about the widespread importance of a Director? Will he then, having been so informed, ACT?

15. Is Mr. C. a "blow-hard" on or off the air about Amateur Radio or does he really know his stuff as an Amateur? Technically—so that he can equate the technical problems that SHOULD come up in connection with Board deliberations? Politically—so that he can cope with the machinations of other less-honest Board members?

Naivete is NOT a desirable characteristic of a DIRECTOR! Mr. C. must not be a "Casper Milquetoaste" but must be able to stand on his own two feet and battle it out with the "power-pros" who will give him a very hard time when opposed.

16. Is Mr. C. willing to accept a job that will take tedious hours of correspondence, long conferences with other Board members (it is hoped), discussions with members on and off the air and the preparation of reports and studies of the Amateur scene? Mr. C. need not be wealthy. There are ample ARRL funds for his expenditures (if he will only request them) but his position or job must permit frequent absence from his desk or bench. He must be willing to spend countless hours in deliberation over Amateur affairs. He will of necessity curtail his operating time, but he need not feel obligated to check into every net and to increase his operating time beyond that point where he can feel in touch with modern conditions. He MUST be cognizant of current events.

17. Is Mr. C. willing to solicit and listen to your views and opinions, and then will he ACT to preserve and enhance Amateur Radio, in the old time basic ARRL tradition by faithfully and fully DIRECTING the operation of ARRL?

If your Mr. Candidate will answer the above questions to your own personal satisfaction, you can then *measure his Q* and decide if you wish HIM to represent you!

If he does—pitch in and ELECT this man. If he does not—tell your fellow Divisional members!

New Product

Tuning Condenser

VHF'ers in particular will be interested in the variable capacitors that British Radio Electronics are importing. These are pretty perfect. There are so many fine details that it is difficult to know where to start. Features: silver plated brass rotor and stator assemblies; full ball bearings front and back; shaft extends both front and back; rotor contacts are nickle-silver, silver plated; two sets of double rotor contacts for each capacitor section; continuous rotation; straight line capacity with two adjustable plates on each section; straight line frequency rotor plates available also if requested; mounting brackets built in separate from stator assembly; each stator segment held in place by four ceramic insulators. These units are available in one, two or three sections, in sizes from 10 to 104 mmfd. Builders who want a tuning capacitor for a VFO or receiver would do well to send for a data sheet from BREI, 1742 Wisconsin Avenue, N.W., Washington 7, D. C.

FEEDLINE

TWIN LEAD

Economy 300 Ohm	100′	$ 1.25	3 lbs
Twin-Lead	250′	$ 2.50	5 lbs
Heavy Duty Deluxe Copperweld	100′	$ 1.98	3 lbs
300 Ohm Twin-Lead	250′	$ 4.75	6 lbs
Spongee 300 Ohm	100′	$ 3.30	5 lbs
Twin-Lead	250′	$ 8.00	12 lbs
Tubular 300 Ohm	100′	$ 2.00	3 lbs
Twin-Lead	250′	$ 4.75	8 lbs
Seacoaster 300 Ohm	100′	$ 4.50	3 lbs
Twin Lead	250′	$11.25	8 lbs
Insulated Open Wire	100′	$ 4.25	5 lbs
450 Ohms 1″ wide	250′	$10.25	12 lbs

COAX

RG-8/U 52 Ohm Foam Coax	100′	$12.50	12 lbs
RG-11/U 75 Ohm Foam Coax	100′	$11.00	10 lbs
RG-58/U 53 Ohm Coax	100′	$ 4.75	4 lbs
RG-59/U 73 Ohm Foam Coax	100′	$ 5.00	4 lbs

OPEN WIRE LINE

300 Ohm Copperweld	100′	$ 2.15	3 lbs
Open Wire Line	250′	$ 4.85	5 lbs
450 Ohm Copperweld	100′	$ 1.90	3 lbs
Open Wire Line	250′	$ 4.50	5 lbs

ORDER DIRECT AND SAVE

Minimum order $5. Please enclose postage as below.

Postage	300 mi	600 mi	1000 mi	1400 mi	1800 mi	beyond
First 2 lbs.	.35	.39	.45	.51	.58	.64
Ea. add'tl lb.	.06	.08	.10	.13	.16	.19

REDLINE

[redacted]

JAFFREY, N. H.

Moonbouncing News

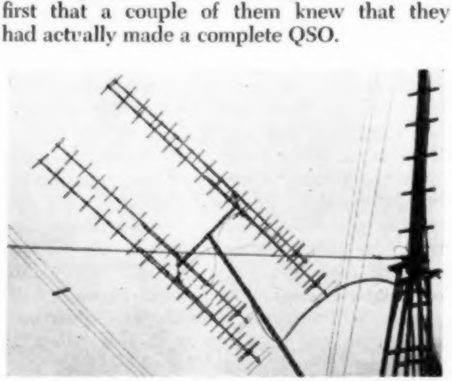
W2NSD/1

KP4BPZ was in there during the ARRL VHF QSO Party on June 13-14 on both two meters and 432 mc. The time and frequency of the skeds were announced by several hundred IoAR member stations and by ARRL's OBS. Many groups were sparked into giving moonbounce a try. All of my antennas were pointed at the horizon, so there wasn't much I could do about it except plan for the future.

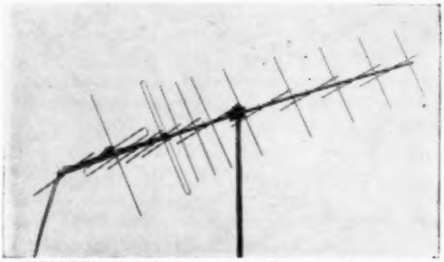
Word reached me during the contest that KP4BPZ had indeed managed to contact several 432 mc stations on Saturday and several 144 mc stations on Sunday. I called Sam W1FZJ for details and got the following list: 432 mc . . . W1BU, W9PAB, HG9RG, W1EHF/1, W9NGE, W1FZJ on AM phone, G3LTF, and W1HIV. The W1BU, W1EHF, W1FZJ and W1HIV contacts were all with the same rig. One of the W9's isn't in the Callbook, so it is possible that both W9's used the same rig. This still gives Gordon four different stations worked . . . not bad. BPZ was heard several places too. K2TKN lowered his dish to the ground and copied BPZ, but with difficulty since Gordon was sending CW at about 35 wpm, which made it difficult to tune in.

On 144 mc Sam reported that KP4BPZ worked W1BU, K2LMG, G2HCG, WB6GZY, DJ3EN, W3TIK/3, W3TMZ, W3LUL/3, W9GAB/3 (maybe that's why there is no W9PAB in the Callbook?), W1HIV, DJ8PL, W4HCZ, DL3YBA, W4FJP, and WIC0. I sent letters immediately to all of them asking for details. Several have answered . . . and I was surprised to find that my letter was the first that a couple of them knew that they had actually made a complete QSO.

The operating position at KP4BPZ looks more like a BC station than a ham setup. Andy KP4BEU is in the foreground, Gordon BPZ is at the key, Rolf K6DSJ is on the left, and Pete K3SSG is hidden Gordon.



DL3YBA heard KP4BPZ S-5 with this 88 element (four 22's) 432 beam. Contact was made on 144 mc with a double ten element beam.

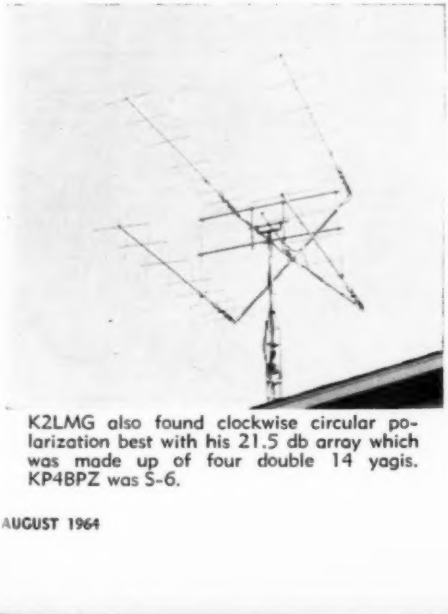


G2HCG's double ten yagis. Best results were with clockwise circular polarization. KP4BPZ was S-4.

The first report came in from G2HCG. Bill was using a set of two 10 element J-Beam yagis mounted on the same crossboom at quarter wave spacing. This provided circular polarization without the usual matching problems. When both beams are fed in phase the result is clockwise circular polarization. When a half wave is inserted in the feeder to one antenna the polarization becomes anti-clockwise. KP4BPZ was received on 144 mc using a 417A grounded grid converter into an AR-88. The signal was subject to violent variations in strength, peaking at S-4, but most of the time in the noise.

Bill reports considerable frequency shift at the beginning of each transmission, probably due to transmitter drift. The G2HCG transmitter ran 1 KW to a pair of 8011's. Signals were poor on vertical, horizontal and counter-clockwise circular, but were manageable on clockwise polarization.

K2LMG in South Lansing, New York copied KP4BPZ the entire time he was on two meters. He used his 21.5 db gain antenna, made



K2LMG also found clockwise circular polarization best with his 21.5 db array which was made up of four double 14 yagis. KP4BPZ was S-6.

212-OX-7-5895 — WEEKDAYS
(Ans. Service) — Leave Message

KITKRAFT CO.

W2FCJ
P.O. Box 406 — Canal St. Sta. New York, N. Y. 10018
HAM GEAR BOUGHT, SOLD, REPAIRED
8-390 Collins only $650.00 — This Month
ALL GEAR GUARANTEED

HEAT DISSIPATING TUBE SHIELDS

See page 24 to 27, Feb. 1964 Issue of 73. For miniature tubes. Made by CINCH.
1½" high, for 7 pin 2" high, for 7 pin
CHOICE 4/$1.10

BC Electronics
2333 S. Michigan Ave., Chicago 16, Ill., CAlumet 5-2235

REDLINE

Though we've advertised hundred-dollar converters, our biggest seller is our HJC-50. This little nuvistor converter is unbeatable for all but the most exacting applications. The circuit is simple . . . so simple you wouldn't expect that it took weeks and weeks of exhausting diddling before we had every aspect of it optimumized. The idea is to have just the right amount of gain so you can drive your receiver well, but not enough to run into overload problems. The grounded-grid 6CW4 provides an extremely low noise front end and contributes greatly to the 3 db noise figure which we strive to better with each unit. A 6U8 crystal controlled triode oscillator and pentode mixer keeps the noise low and the gain up.

The 6.3 volts and 1 ampere and 150 volts at 40 ma required to power the HJC-50 can easily be borrowed from your communications receiver . . . or supplied by our HJS power supply which is designed to plug right into the HJC-50 ($9.95).

The HJC-50 permits you to tune the six meter band by tuning your communications receiver between 14-18 mc.

The HJC-50 is available by direct mail from Redline, Jaffrey, New Hampshire. It is completely guaranteed: your money refunded if you want it back for any reason whatever.

Price: $31.95.

HJS

HJC-50

REDLINE

JAFFREY, N. H.

up of four 14 element yagis with both horizontal and vertical elements phased to provide any type of polarization. The converter was a 7077 grounded grid followed by a 417A and a 75A3. The transmitter was a 6N2 Thunderbolt. Reports exchanged were 569 and 579! Using a bandwidth of 150 cps the BPZ signal varied from the noise up to 20 db over the noise. Most interesting of all was the five second delay between transmissions waiting for the radio signals to cover the path.

DL3YBA near Hannover, Germany, reported BPZ at S-2 on 144 mc with his double ten element beam. Contact was made running 1600 watts input, with probably 600 watts being radiated by the antenna. Fritz's four 22 element yagis on 432 brought in BPZ an S4, but no transmitter was ready as yet.

I'll try to let you know more about the others who have succeeded with moonbounce. In the meanwhile, have you thought over what is needed to enter this activity? The primary requirement is interest. Low noise figure converters are not hard to build (or expensive). High power is not very difficult either. But the antenna . . . ahhh, there is the key to moonbounce. None of the antennas used so far have been beyond the achievement of the average amateur, except those used by BPZ and Sam, W1FZJ. Does anyone know where I can get a large dish?

. . . Wayne

Correspondence from the Members

Letters we bet you won't see in QST

The American Radio Relay League
Dear Sirs;

I received my first license W2UIW in 1941 and passed my Class A ticket shortly after. This license expired by my error and I now hold the call K3FXR.

I let my subscription to QST expire many years ago when I left you were not providing the necessary leadership in the post war years concerning incentive licensing. In particular your position on Appliance opperators.

Let me now renew my membership and say "let's go with this incentive business." I am a communications engineer with a degree in engineering and hope that your proposal will be so strict that I can't quite qualify for complete privileges.

Charles Fenner K3FXR
Shippack, Pa.

Aha, here's a fellow in favor of RM-499. He's going to throw all you others off his bands. In 1941 they were issuing the W20's, as I recall . . . Wayne.

Dear John:

I am enclosing herewith the QST Expiration Notice along with my check in the amount of five ($5.00) dollars for another year—even though I received a letter from your assistant in reply to my letter to you, thanking me for my letter telling why I was not renewing my membership—something that was not in my letter, and proves that you and your staff do make mistakes. All I was asking for was your resignation for not doing the job for which you are paid.

I have just returned from attending the 32nd National Convention of the Mexican League of Radio Experimenters and it was certainly disgusting to note that ARRL was not represented, even though the Mexicans had a big sign up welcoming ARRL. It was further disgusting to note that our southwestern director could not even keep a schedule with one of our California Hams for the purpose of taping a speech from him to the convention. Another ham answering the scheduled call, telephoned his home to find out that he was out at a park, but was due back soon—15 minutes after the schedule.

It is a shame that you could not have attended this convention as I am sure that you would have found out from our Mexican friends just how to treat your fellow man. In not one instance did I notice anything but decent friendly treatment to all. Quite different from the high and mighty treatment we, who pay your salary, receive from you. But then, that is to be expected from ARRL from what I have observed in the two years I have been a member. I will continue to be a member, so that I can have the privilege of helping to vote out of office the present director for our area. This will be our answer and effective.

I am sending a copy of this letter to Wayne Green so that at least someone will know that all—or not even the majority of the amateurs are in agreement with you and your friends.

R. R. (Dick) Bauer K7UOY
Warren, Arizona

Dear Mr. Huntoon:

As I ran my finger through the June issue table of contents, I saw the call W6SAI pg. 28. I didn't even look to see what the title of the article was. My past experience with this call meant good reading. When I saw the title of the article, I thought it a bit different from the W6SAI Oscar, S-9 Signals, Quad Antennas and other technical articles, but figured it would be good. I read the article titled: "A Look Inside Petition RM-499," twice because I couldn't believe my first impression. First of all it was not a look inside Petition RM-499 as the title states. It was just another review of the letters for and against the petition with a slightly different twist. Mr. Orr attacked all or some hand picked letters and fellow hams who wrote them against RM-499. Mr. Huntoon, I would like to come to the defense of the hams he attacked.

#1. In his first comment Mr. Orr says that hams in favor of a poll or vote are ignorant to basic democratic process. I don't think so Mr. Orr. I live in a town where a vote was taken every time our local government wanted to make any changes that effected the majority of the residents. I have seen a handful of votes put school busses in my town, a library, extra classrooms and even a private beach. This is basic democratic process in our form of government. Congress is a little more complex and I would hardly compare the ARRL organization to that body of democratic representation. I would say your comment was unfair Bill.

#2. I agree with your second comment Bill and I think we all realize the primary reason for amateur radio, but lets not misinterpret the word hobby. The dictionary defines the word hobby as: "a favorite pursuit." If radio is something you like to work with, then naturally you're going to try and work with it the best way you know how. I am not a technical expert on radio theory but I have a thorough working knowledge of my equipment, I like to build electronic components and I don't restrict myself to radio alone. A sense of pride and accomplishment go along with things you do and build when its something you like. When a ham is a service to the public, its food for this proud feeling he has. You demonstrate to the public a special hidden talent. Who in his right mind would pass up an opportunity such as this. I consider amateur radio as a service for the public and for me, a favorite pursuit.

#3. I think hams have every right to think first of their personal investment. Amateurs have to build or purchase the equipment before they can be of service to the public. The people who manufacture the parts and equipment are not giving them away. Hams have to shell out good old hard earned money. If the petition causes a flooding of the used equipment market, values will drop and the hams are the only loosers not the manufacturer or the public.

#4, 5, 6. I agree 100% Bill.

#7. Now here we go again. "RM-499 is unfair as it takes away my rights." Hams who said this, are correct and you proved this with your own comment Bill. Part 97 is F.C.C. repeat F.C.C. regulations and not A.R.R.L. regulations. RM-499 is an A.R.R.L. petition *to* the F.C.C. The Leagues petition is an infringement of the rights of its own members. This gives the hams the legal right to complain.

#8. Why should a person have to demonstrate phone qualifications? What is so special or difficult about operating phone? Other than building a modulator and being microphone shy, I see nothing extra special. Both are easy hurdles to clear. The contact is a little more personal and usually shorter and that's about the size of it. How does the public benefit? CB operators use phone and they don't have to take any exam at all.

#9, 10. I am not that familiar with either one of these problems but if the form of testing has been abused, then something should be done to rectify that situation. You could say that comment #10 will take quite a few old timers off 75 phone.

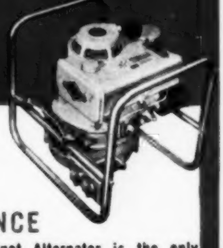
The section titled: "Interesting Side Observations" was very uninteresting and uncalled for. You're really scraping the barrel when you pick on someone because he's a poor speller. They may be weak in spelling but it shows a weakness in character on the part of the author when he resorts to tactics such as these. The opening sentence in the last paragraph sums up very nicely how lopsided the article was. I think the entire article should have been written in italics. The letters for and against the petition deserve more than a casual observers opinion. I don't see why the poor stamp collectors and hot-rod racers were pulled in at the end. They must have complained about TVI at one time or other. Come on Bill, give us some of your other articles that we can digest and feel we have learned something.

To conclude, the only thing you accomplish with RM-499 is to be in the F.C.C. spotlight. You might say it's like a little boy doing something clever in school and hoping the teacher will take notice. Well you're missing the target entirely. We don't have to prove ourselves to the F.C.C. We have to prove to the public, our country and our neighboring countries the importance of our existence. Why not show the F.C.C. a program for cleaning up sloppy operating habits, inconsiderate operating on the air and all other QRM on the ham bands? Our intelligence does not have to be tested, merely some age old regulations have to be inforced. This is what the F.C.C. is looking for.

John A. Snee W2BID
Jamaica, New York

ZEUS Portable Electric Generator

World's simplest, most reliable power generator



VIRTUALLY ELIMINATES RADIO INTERFERENCE

- Exclusive Permanent Magnet Alternator is the only moving part—no brushes, slip rings, bearings, commutators, etc., to produce irritating generator noise common to ordinary portable units.
- 115/220 volts, 60 cycle, AC, 1250 watt continuous rating.
- Gasoline powered—quickly adaptable to liquid propane
- Burn-out-proof against overloading or sudden surges.
- Compact—one man can handle.

Three models — 1000—1250—3000 watts

Available now from your local electronic parts distributor

the antenna specialists co.

12435 Euclid Ave., Cleveland 6, Ohio
Exp. Div. 15 Moore St., New York 4, N.Y.

CONVERTER SALE

New model series 300 with 3 VHF transistors, crystal, and more than 30 high quality parts. Carefully assembled and tested. Measures only 3" x 2¼" x 2". Low noise and better than 1 microvolt sensitivity. Made in USA and guaranteed. Available in the following models for 12 volts DC:

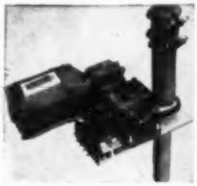
Model	Input mc.	Output mc.	Price
300-A	26.965-27.255	1.0-1.255	$10.95 ppd.
300-B	50-51	.6-1.6	$10.95 ppd.
300-C	50-54	14-18	$10.95 ppd.
300-D	144-148	50-54	$12.95 ppd.
300-E	144-145	.6-1.6	$12.95 ppd.
300-F	144-146	28-30	$12.95 ppd.
300-G	14.0-14.35	1.0-1.35	$10.95 ppd.
300-H	5.0 (WWV)	1.0	$10.95 ppd.
300-X	Choice of 1 input freq & one output freq between .6 & 160 mc		$14.95 ppd.

Note: All above converters have a tuned R.F. Stage.

Order now while prices are still low.

All above converters are supplied with Motorola type connectors. For two SO-239 connectors instead, add 75c. N.Y.C. residents add 4% sales tax.

VANGUARD ELECTRONICS LABS Dept. H-8
190-48—99th Ave. Hollis 23, N. Y.



TELREX ROTATOR-INDICATOR SYSTEM MODEL TS238-RIS

Mast Feeds Thru Rotator For Safe, Easier, Installation

- 1300 IN/LBS ROTATION TORQUE
- SELF LOCKING BY STURDY WORM GEARS
- SELSYN AZIMUTH INDICATION
- ACCOMMODATES 2" O.D. MASTING
- MALLEABLE CAST MASTING CLAMP SUPPLIED
- OUTPUT SPEED APPROX. 1 RPM
- WILL FIT INTO OR ONTO A 6" SIDED TOWER

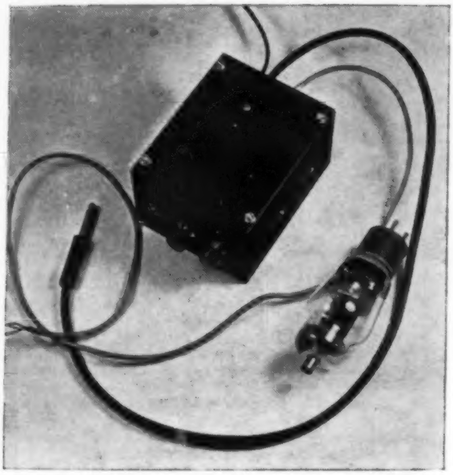
A Really Sturdy ROTATOR-INDICATOR SYSTEM— NOT a Modified TV Rotator! Designed To Out-Perform, Outlast!

$238.00 F.O.B.

ALSO:
TB278-RIS $278.00
TS345-RIS $345.00
TS435-RIS $435.00
TS535-RIS $535.00

Write for FREE PL64 Describing Rotators and Antennas

TELREX LABS.
ASBURY PARK, N.J.



The completed unit shown with an 807 for size comparison.

Another Keyer

Adam Keller K9SGZ

Being a CW hound by nature and choice, I am constantly building gadgets which are intended to make this mode of operating even more enjoyable than it is. The keyer described herein claims no radically new concepts, but is a simple, rather inexpensive device which will send perfect code as long as the nut behind the wheel is working the paddle in a proper manner. It is completely self contained, other than the paddle, and includes its own power supply and keying relay. It is built in a 3 × 4 × 5 chassis box with the transistors mounted on homemade circuit boards. It may be used with either a "squeeze" paddle or with a conventional paddle, and is *not* self completing. This feature was purposely left out of the keyer, even though it may be added with just three or four parts, since when the dots and dashes are self completing, there is no more individuality left in the device. Also, it allows the operator to forget how to send proper CW and makes it very difficult to transfer easily from a "bug" to a keyer and vice versa. You can very easily prove this statement to yourself, just ask one of your friends who has used a self completing keyer for some time to try to send CW with your old favorite "bug". If he can, he is a rare animal indeed. This is a point many people disagree on, but it is a fact like it or not.

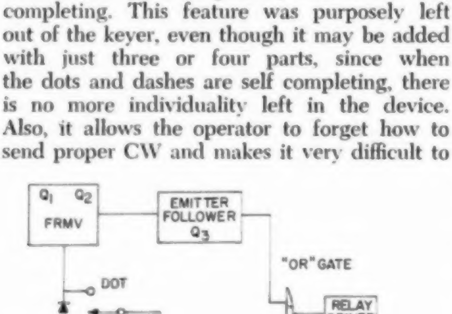


FIG. 1

The keyer is rather conventional in that it consists of a free-running multivibrator which generates dots, driving a bistable multi-vibrator which adds to the dots to produce dashes. The block diagram is shown as Fig. 1. The circuit is rather novel, in that it uses only one power supply, whereas most transistor units described elsewhere use both positive and negative supply voltages. This saves a bit on cost as well as simplifying the power supply. Two circuit boards are used, one containing the FRMV and half of the "OR" gate, the other containing the BSMV, the other half of the "OR" gate, and the relay driver transistor. Photo 1 shows the layout of the board containing the FRMV and it's associated emitter follower, while photo 2 shows the BSMV board. The cutout in the BSMV board is for clearance of the keying relay. With more precise measurements taken before construction, it is possible to get by without doing any hacking here. The stack of capacitors on the FRMV board make up a pair of 1 mfd capacitors, again because of availability. Considerable space may be saved here with a single capacitor. These boards are held away from the chassis box side panels by some spacers made up of two #8 nuts. Care

VISIT OUR NEW STORE

TEST EQUIPMENT

RCA WR39A TV CALIB.	$35.00
RCA WR-59A TV SWEEP GEN	$35.00
B&W 300 AUDIO FREQ MTR	$50.00
GR-732B DISTORTION & NOISE MTR	$225.00
GR-805A STANDARD SIG. GEN	$325.00
GR-650A IMP BRIDGE	$135.00
GR-1604 COMPAR BRIDGE	$175.00
KAY MEGAMARKER	$50.00
KAY DUAL MEGAMARKER	$65.00
KAY MEGAPIPPER	$40.00
KNIGHT-FS-344 FREQ STANDARD	$85.00
GE SQ WAVE GEN	$125.00
FERRIS 20B PUSH BUTTON SIG GEN	$45.00
FERRIS 32B N.F.M.	$275.00
DUMONT 294A 10MC SCOPES	$125.00
TEKTRONIX 511	$145.00
TEKTRONIX 512	$175.00
TEKTRONIX 514	$350.00
TEKTRONIX 517A	$600.00
HP-200C AUDIO OSC	$60.00
HP-330B DIST. ANAL.	$350.00
TS-175 FREQ MTR	$135.00
TS-382D AUDIO OSC	$225.00
TS-497B/URR	$275.00
LA-592A PULSE GEN	$250.00
PHASE ANGLE VTMR	$250.00
AN/USM-29 DIGIT SIG GEN & FREQ MTR	$1000.00

MANY MORE TEST SETS WRITE

TRC-7-100-150MC WALKIE TALKIE	$125

RADIO RADAR

ARN-21 B AND C TACAN	
R390 .54KC-40MC	$650.00
R-390A .54KC-40MC	$900.00
R-388	$550.00
SP-600	$450.00
APX-6 RT	$25.00
63MC IF STRIPS	$12.95

MANY OTHER ITEMS WRITE

WANTED WANTED

SG-1, SG-2, SG-13, OMNI Test Sets, R-390 & 390A, R-388, SP-600, APR-9, APR-14, GRC-3 thru 8, GRC-9, 10, 19, 26, All Types Test Sets, Radio, Radar Sets, Tacan, Write, Wire, Call.

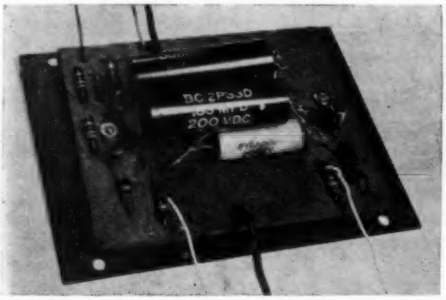
Everything Guaranteed
We Pay Freight in U.S.
Payment with Order.

TECHNICAL SYSTEMS CORP.

42 W 15th St NY 11 N.Y. CALL ED CHAROL CH-2-1949

should be used here to ensure that none of the wiring on the boards touches the side panels. A short circuit here can cost you a transistor or two. Photo 3 shows the interior of the chassis box along with the two completed side panels. The speed control is on the left, the weight control in the center, and the power switch on the right. The power transformer is mounted on the right wall of the box, while all diodes and filter capacitors are on the left wall. The capacitor which may be seen on the left wall is the 1000 mfd unit, the diodes and 100 mfd capacitor being hidden by the large capacitor. The keying relay is mounted on the bottom wall along with a terminal strip used as a tie point for the power cord.

When constructing the unit, it is advisable to construct the power supply in the chassis box first, so that it may be used for checkout of the boards. Once the power supply is complete, the FRMV board may be constructed and checked out. With the FRMV board connected to the power supply, leave the emitter



DOW RADIO
& Electronics

1759 E. Colorado Blvd.---PASADENA---Mu 1-6683
222 West Main St.----SANTA MARIA----WA 2-1765
5857 Hollister Ave.--------GOLETA-----WO 7-3401
1505 S. Oxnard Blvd.-------OXNARD----HU 6-6352

HIWAY COMPANY

SATISFACTION GUARANTEED

1147 Venice Blvd., Los Angeles 15, Calif.

Tons of Meters, Relays, Capacitors, Transformers, Dynamotors, Tube Sockets, Coax Connectors etc. Write your needs.

6 METER CONVERTER WITH NUVISTOR PRE-AMP

Unbeatable performance at an unbeatable price. Only $10.00 ppd.! Complete with 6U8A, 6CW4 tubes and choice of 36 mc. crystal for 14-18 mc. output or 49.4 mc. crystal for broadcast band output. Fully assembled, tested and guaranteed. Sensitivity .1 microvolt. Noise figure 2.5 db.

VANGUARD ELECTRONICS LABS Dept. H-8
196-48—99th Ave. Hollis 23, N. Y.

Subscribe to **HEED.** Ham Electronic Equipment Directory.

The Ham Directory for Selling, Buying, or Trading ELECTRONIC GEAR. . . . **HEED** is published once a month and Subscription is only $1.00 per year. . . . Rush your $1.00 to **HEED**, 1225 Hillside Place, North Bergen, N.J. Sample copy 35c.

LOOKING? SHOPPING? TRADING? TRYING TO SAVE MONEY?

Write Bob Graham for Special Deals on New and Reconditioned used gear. Cash or Budget.

Graham Radio

Dept. C., Reading, Mass. Tel: 944-4000.

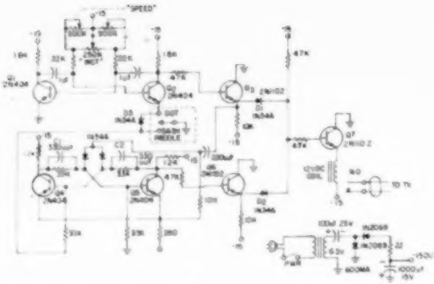
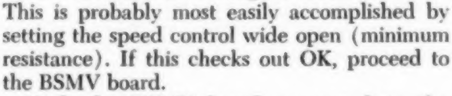
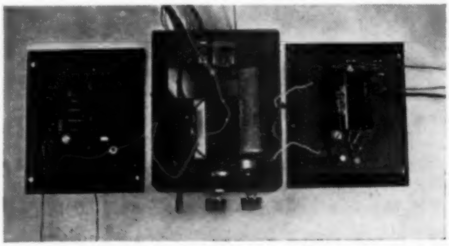


FIG 2

of the keyed transistor (Q_2) disconnected. With a voltmeter, measure the voltage from the collector of the keyed transistor to ground. This should be about 14 volts or so (negative, of course). Then measure the collector-to-ground voltage of the other FRMV transistor. This should be about -0.2 volts or so. Notice that the speed and weight controls must be connected temporarily for these checks. Now, with the voltmeter still connected from one of the collectors to ground, connect the emitter of the keyed transistor to ground. You should note the voltmeter reading change toward about -7 volts. This will be affected by the weight control. You should find some setting of the weight control where the collector voltage is about -7 volts. This is probably most easily accomplished by setting the speed control wide open (minimum resistance). If this checks out OK, proceed to the BSMV board.

With the BSMV board connected to the power supply, leave the key lead open. With a voltmeter, measure the voltage from the collector of Q_5 (see schematic) to ground. This should be about -12 volts or so. Then measure the voltage from the collector of Q_4 to the emitter of Q_4. This should be about -0.2 volts or so. If these voltages check OK, all interconnections may be made between the two boards and their operation may be checked. With the "dot" lead grounded, the FRMV should operate and it's collector voltages should be about -7 volts as described above. With the "dash" lead connected to ground, The FRMV should still operate as before, but now the BSMV should also be running. This may be checked by measuring the voltage from either collector (Q_4 or Q_5) to ground. This voltage should be about -7 volts also. It should be noted that all the above voltage readings are dc readings, which are actually the average voltages of the waveforms seen on the collector. If an oscilloscope is available, the waveforms shown as Fig. 3 should be observed when the "dash" lead is grounded.





If all the above checks are OK, the keying relay may be connected to the transistor Q_7 and proper transmitter keying should be noted. If a 24 volt relay is used, as in the author's model, the spring will have to be weakened by stretching before the relay will operate on the low voltage used in the power supply. If a 12 volt dc relay with a coil resistance of 500 ohms or greater is available,

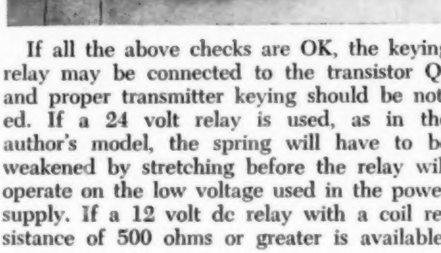


FIG 3

NEW ! !

Swan-400
5 Band 400 watt
SSB Transceiver
Order it from
Henry today!

Also New — Henry's new store at
431 E. Green St., Pasadena, Calif.

SWAN 400
$375

SWAN 420
$120

11240 West Olympic Blvd.
Los Angeles 64
Ph. (213) BR 2-0861, GR 7-6701

Henry Radio Stores

Butler 1, Missouri
ORchard 9-3127

931 N. Euclid Ave.,
Anaheim, Calif.
PR 2-9200

Best Terms
and Trades
and our *Famous*
Personal
Service

it may be substituted directly. Once the relay is operating, the weight control may be adjusted by "ear", or more precisely by using an indicator such as the grid current meter on your transmitter. If the transmitter grid current runs, say 5 ma with the key closed, a string of dots should produce an average reading of about 2.5 ma on the grid meter. The dashes are automatically correct if the dots are correct and the BSMV is running.

From here on, the package may be "buttoned up" and you are in business with correctly formed dots and dashes, with the operator still controlling the keyer, not vice versa.

A hint here may save you a little money, almost any switching or audio transistor will work for Q_1, Q_2, Q_3, Q_6, and Q_7. They should have about a 20 volt or greater collector voltage rating and Q_7 should be good for 50 ma or so of collector current. After this, you're on your own. Oh, yes, if you experience any difficulty getting the BSMV to run, providing the circuit is wired correctly, try increasing the values of C_1 and C_2 slightly. They should require very little, if any, change if you use 2N404 or 2N604 transistors or equivalents.

Have fun and will CU on 80 meters around 3650 kc. That's home to me.

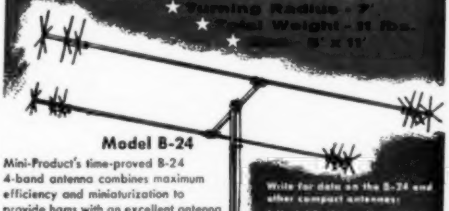
. . . K9SGZ

Want High Efficiency and Small Size?

6 10 15 20 METERS

MINIATURIZED-4-BANDS

★ 500 Watts AM.
★ Turning Radius - 7'
★ Total Weight - 11 lbs.
★ [illegible] 5' x 11'



Model B-24

Mini-Product's time-proved B-24 4-band antenna combines maximum efficiency and miniaturization to provide hams with an excellent antenna where space must be considered.

Like all Mini-Products antennas, the B-24 employs "Multiple Hat" loading for maximum efficiency. TV rotor adequate; Feed line, 50 ohm coax; SWR 1.5:1.

Amateur Net
$59.95

Write for data on the B-24 and other compact antennas:

- Model B-4010—40 and 10 M. two 18' elements, 10' beam Net $79.50
- Model C-4—Coax Vertical (no radials) 6, 10, 15, 20 M. Net $34.95
- Model M-4 Mobile 6, 10, 15, 20 M. Net $16.95

Patents pending

Mini-Products, Inc.

1001 WEST 18th STREET • ERIE, PENNSYLVANIA

New Products

Eight Band Receiver!

Hammarlund has introduced the first ham receiver to cover 2-160 meters in one package, their new HA-170A-VHF. This is the regular HQ-170A plus built-in nuvistor converters for 6 and 2 meters. Activity on two meters is growing rapidly, so you might look closely at this receiver. The converters in the HQ-170A-VHF are right up there with the best available, complete with nine tuned circuits to give good rejection of unwanted signals.

Killowatt Linear

The Heathkit SB-200 KW Linear Amplifier is a completely self-contained desk-top unit which provides 1200 watts PEP SSB, 1000 watts CW in a grounded grid circuit. It covers 80 through 10 meters and is designed to mate with the SB-400 Heathkit transmitter, the soon-to-be-released SB-100 transceiver and nearly all other SSB and CW exciters in use. Antenna switch and SWR meter are built in. Price? $200!

New Catalog

International Crystal has a new catalog just out. This is an interesting 24 pager showing all of the Add-On Circuits they have available. They have really expanded this concept tremendously, covering audio amplifiers, converters, sideband filters (xtal, natch), multivibrators, oscillators, transmitters, power supplies, voltmeter, etc. Write to International Crystal, 18 North Lee, Oklahoma City, Oklahoma 73102. Mention 73?

SSB Transmitter

The Heathkit SB-400 transmitter is designed to match the Heathkit SB-300 receiver and runs 180 watts PEP SSB, 170 watts CW on all bands 80 through 10 meters. The linear master oscillator is calibrated one kc per division, 100 kc per dial revolution, with bandspread equal to ten feet per megacycle. It gives 500 kc coverage in each band switch position. Upper or lower sideband, VOX, PTT, CW break-in, built in antenna switch, ALC, etc. Price is $325.

Letters

Dear Wayne,

I just returned from a visit to the World's Fair and I can tell you first hand that you are correct in your statements on K2US. I finally found the door leading to the "Glass Cage" housing the wonderful display of Hallicrafters equipment. There were three operators. I assume they were amateur radio operators as they all wore brown jackets with K2US on the back. All I saw was their backs, wandering around like chickens with their heads cut off. There was a speaker mounted on the wall between us with directions on how to get those inside to know we were outside. After several attempts to get a "CQ" through to them, following the printed instructions posted beside the wall, I gave up and walked away. I then went to WA2USA and found the equipment, but no operators. I inquired as to the reason and was told that it was not ready to go on the air as construction was not completed. I am glad to find out the real reason in the July issue of 73. Too bad the ARRL has the power to do most anything they desire.

Charles O. Fleming WA8GLR
Sylvania, Ohio

Dear Mr. Green;

A group of amateurs in the San Francisco, California, Bay Area are interested in getting a national calling and operating frequency for wide-band FM operations in the 420-450 mc amateur band. This frequency would be the UHF equivalent of 52.525 mc in the 6 meter band and 146.94 mc in the 2 meter band. Several members of the club have operating base and mobile stations on a frequency of 449.500 mc. There are seven stations on the air now, five more with the necessary equipment, and many more members have expressed interest. Inquiries among various FM groups around the country have shown that there is no common frequency as yet in this part of the band, so perhaps this would be an appropriate time to establish such a frequency.

The members of our group have selected 449.500 mc for several valid reasons. These are listed below, not necessarily in order of their relative importance.

1) All surplus 450-480 mc FM two-way radio equipment we have tested will tune onto this frequency without conversion or loss of receiver sensitivity or transmitter power output.

2) This frequency is quite isolated from the national AM frequency of 432.000 mc. Since, for all practical purposes, AM and FM systems are incompatible, this isolation will prevent conflicts between operators using different types of emission.

3) A common 100 kc or 500 kc frequency standard may be used to set frequency by zeroing the receiver discriminators and netting the transmitters to the receivers. Also, in commercial systems, channel spacing in the 450-480 mc band is 100 kc. The 449.500 mc channel is an integral number of 100 kc steps inside the band.

We are writing to you in the hopes that you will consider our proposal and perhaps publish comments on the subject and solicit comments from other groups with interests along the same lines as ours.

Alan Christian WA6YOB
Grizzly Peak VHF ARC

Sounds like a good idea to me . . . Wayne.

Dear Wayne,

Well, I'm finally doing it. I'm finally coughing up the $10 to become a Founding Member of the Institute of Amateur Radio. I held off as long as I could, but now my conscience is bothering me. After all, who am I to freeload on all those benefits that the Institute will afford to amateur radio; the bands that it may cause to be saved for us at Geneva; the benefit of getting legislation passed when we need it; but most of all I get the satisfaction of knowing that I belong to an organization that represents all amateurs, and not just a hand picked few.

I believe, Wayne, that the $10 membership dues is just a drop in the bucket compared to what most of us have spent on our rigs. Where else could we get "insurance" so cheap, insurance that our equipment won't be obsolete in a couple of years as a result of the big doings in Geneva.

Well Wayne, this is why I am joining the Institute of Amateur Radio. Frankly I can't see why every ham who cares about the future of amateur radio doesn't join.

Ed Hartley WA2VGH
Brooklyn, New York

Wayne:

You goofed. In my article, "The Gardner Modulator Revisited" in the May issue you show a lead going to B + in Fig. 2. This is an error. There is no B + necessary with this circuit. This is one of its big advantages. B + is derived from the drop across the 6Y6 when plate current flows through the common amplifier modulator circuit. Thus only 6.3 vac is required.

73
Barry Hoyt
WA2AKK

Gentlemen:

I am writing the following because I am interested in Amateur Radio, the services it offers, both personal and public and above all, its continuance.

I read most of the articles every month in your magazine with great interest and being a natural "ham," I feel I have to put my two cents worth in also.

The general conclusion I get from most of those letters and articles concerning the fate of Amateur Radio at the coming Geneva convention is one of doom and gloom. I have to agree with most everything that it said; we amateurs have our problems as everyone else does. The problem as I see it is: what do we about it and are we willing to sacrifice of ourselves to see that something is done about it. In other words I am going to offer what I consider to be an offensive step. I am not satisfied to just "hold our own" frequency allocations, but instead I would like to see more of the spectrum allocated to Amateur Radio. Well and good you say, but how is that ever going to come about. Well maybe it won't but it won't be because I haven't given it the old college try, so to speak.

From what I can gather from this edge of the map, the only thing these people that control our frequencies really and I mean really pay attention to is "hard nose politics." Who in this wide world is in a better position for collective bargaining than Amateurs with Mr. Barry Goldwater in their ranks. I don't like the word politician and I don't mean to associate it with Mr. Goldwater but it seems that politics is all some people understand. So, whats wrong with pulling together by printing a ballot or poll in your magazine and other amateur magazines with definite propositions put before the ranks and if amateurs can't mark them and return them to a collective point then they deserve to lose their privileges. Then after we feel we have a majority of the feelings of the amateurs, present this in a petition form to our state Congressmen or Mr. Goldwater or whoever should present our views to the powers that be and see if we don't get some action. I believe they will listen to a majority, if we get a majority together.

How do you think commercial ratio has taken frequencies away from Amateur radio in the first place but by politics and by a powerful lobby in Congress. Well, why can't we Amateurs have the same thing if that is all they understand.

I say let's be practical, let's get together and make some sensible demands of our own through the proper channels and be prepared to back up our demands. I for one am willing to work to stay on the air on our present frequencies, are you . . .

Jon Raine K5IUS
Uvalde, Texas

You've got the idea Jon . . . fight demands with demands and fight lobbies with lobbies. That's why we have the Institute of Amateur Radio. . . . wayne

Dear Wayne,

Looking down at my car's odometer yesterday, I saw it roll over to 737373. Since I have not exactly ignored your publication, this sequence created a chain of mental aberrations which resulted in my sending the enclosed check for a three year subscription to your rag. I enjoy perusing your articles and have learned much of practical value from the technical articles by Jim Kyle and others. In fact, I like it so well that, although I have not previously subscribed, I have nearly all back issues since you introduced "73."

Concerning the current agitation over conditions in the hierarchy of the ARRL, and other individuals whose personalities and/or opinions you do not agree with or care for, I feel you could accomplish your purpose of exposing and pointing our their errors without the use of such bitter and sarcastic language. I feel that hams, on an average, are blessed with a high enough intelligence to evaluate and make their own decisions on controversial subjects when all the facts have been presented to them objectively and dispassionately. Personally, I view with distaste and suspicion any attempts to influence my thinking by methods other than a simple exposition of the facts. I question the motives of a man that attempts to prejudice me rather than convince me. My criticism is intended to be solely constructive, since I heartily support your efforts to reveal the true conditions in the League. I believe you are doing all hams a service and only wish to point out that you may antagonize some by your method of attack.

Keith Carlin WA6AOM/Ø
Minot, North Dakota

You've made a good point Keith. Undoubtedly the straight facts would get the message across to many fellows . . . but then you must take into consideration that I get great enjoyment out of being sarcastic and I suspect that many readers enjoy having me zing people a bit. You'll note that I do not waste time zinging people who can take it, only those with no sense of humor who gnash their teeth in frustration. And please don't read bitterness into my histrionics. I'm having a good time . . . I sit back and read my editorials and laugh . . . try it.

Some Important Design Hints with Transistors

William Eslick KØVQY
2607 East 13th
Wichita, Kansas

Transistors are invading the vhf field, believe it or not! I know some die hard hams who won't accept the fact as yet and others who have 'tried' and gave up cursing the little hunks of metal.

In this article, I hope to tell you of a few pitfalls to avoid and some helpul hints you won't find outside of 73. If you have lots of that green stuff to buy transistors, don't read this—but if you save your lunch money to get that little precious jewel, then this is for you.

One thing to be sure and do is to have a meter (milliamp) in the supply line. This will warn you when you are exceeding the rated input current and will let you know when something goes wrong. So have a few current meters handy! Another must is a resistor in the emitter circuit, bypassed of course. When the transistor tends to reach thermal runaway, (as it gets hot it will draw more current, get hotter and draw still more current till it is ruined). Without theory this resistor provides a voltage drop that bucks the forward bias—more current the transistor draws, the more 'bucking' is done. Less forward bias means less current drawn. This resistor will range from 10 to 15 ohms for audio or rf final and from 100 to 1k ohms for audio or rf.

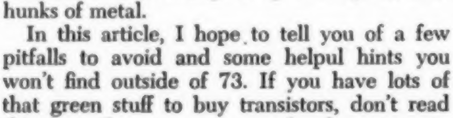


FIG. 1

By these two methods, we have come a long way in saving our investment. One more very important thing, for gosh sakes, remember polarity. Seems like this fault is high on the list for the cause of ruining transistors.

Remember this little thing . . . If your transistor is a pnp (or npn) the middle letter tells you the polarity of the collector voltage and also forward base bias if any is used. So if you have a pnp, then the collector supply will be negative with positive going to the emitter circuit and forward bias, if any, will be negative.

In case you have not found this out, in the common circuits, unless the transistor input and output's are tapped down on the tank coil you will not be able to use a gdo very easily. Reason is that the transistor shunts the tank coil with a low impedance and the dip is hard to find (if there at all). Another difficulty that has thrown more than a few is: they design a tuned circuit, plug the transisor in and it won't work! The transistor input (output) capacitance will alter the tuning very much. Even with a tuned slug coil, turns will have to be removed. (One oscillator circuit I used had a 20 mmfd capacitor across the tank with core about half in the coil. Gdo okay, but with transistor in,

telrex "BALUN" FED INVERTED "V" ANTENNA KITS
SIMPLE-TO-INSTALL, HI-PERFORMANCE ANTENNA SYSTEMS:
1 KW P.E.P. Mono-Band Kit . . . 1KMB1V/81K . . . $14.95*
2 KW P.E.P. Mono-Band Kit . . . 2KMB1V/81K . . . $18.95*
*Kit comprises, encapsulated, "Balun," copperweld, insulators, plus installation and adjustment instructions for any Mono-band 80 thru 10 Meters. Also available 2, 3, 4, 5 Band Models.
Mfd. under Pat. 2,576,929
Write for TFLREX PL 6-5
TELREX LABORATORIES
ASBURY PARK, NEW JERSEY

I wound up with 5 mmfd across the coil before it would tune to frequency. Now you are warned!) In Fig. 1 is a diagram of a simple rf voltmeter. It is uncalibrated (although the resistors and meter give ranges of 1, 2½ and 5 volts) because loading/shunting affect would make any reading useless except as for the presence of rf and that is its sole purpose.

This meter must be connected across a load or it will not read. Do not use it across a dc voltage source that exceeds the range of the meter.

In a circuit like Fig. 2 with voltage supplied to the oscillator section only, both transistors plugged in, meter connected between base and chassis (or emitter) of the final, then I can work with the oscillator circuit till it oscillates. A reading of 30 on range one to 35 on range two is roughly what I have read with various oscillator circuits and frequencies. When the oscillator circuit is working properly, connect a dummy load (bulb or resistor) to the antenna output terminals and connect the meter across this and work with the final (or next stage) until it is working. This little indicator is almost a must if you intend to experiment with transistor circuitry. Now for a few hints: I hope you may find the cause of your failure and disgust mentioned here and start saving lunch money again for transistors.

First try to get some design reports. Amperex and Texas Instruments are very nice in sending booklets with circuits that will give you a good idea how to start. Some of the transistors have a very low input and output impedances and the old 'standby circuits' will not work! Have you had an oscillator working properly and then plug the final transistor in and the oscillator quits? Loosen the coupling or remove a turn or two from the link coupling. The oscillator is loaded too heavily.

In your output circuits, regardless of whether you use parallel or pi network, use a coil that you can tap the collector a turn at a time (and retune the trimmer of course) until you reach the best point as indicated by meter or dummy load. On one of my 50 mc finals using a Amperex 2N2786, the tank is 6 turns of B&W 3007 with a 5-20 mmfd trimmer. The collector is tapped 1½ turns from the cold end for best output.

In another circuit (using a 2N2220) the collector was connected to the center tap of the coil for best output. From this, you can see that it is important but cut and try, procedure to find the proper collector tap on the coil for the best output. The grounded base configuration is the best to use. In most of the vhf transistors I have worked with, using grounded emitter (base driven) circuits, the final stage will take off on its own. I have had the dummy load light up and think to myself, "Good, I've really got some output." Then I would pull the crystal momentarily from it's socket and the dummy load still was lit. To fix this involves too much neutralizing circuitry. It isn't worth the effort. A warning: a transistor oscillating like this can ruin itself quickly. I have found this out to my sorrow and purse!

Another warning. If your final is capable of putting out over 100 milliwatts, always have a dummy load connected or buy another transistor! I wrote one crystal manufacturer about 5th and 7th overtone crystals in transistor oscillator circuits and they did not recommend using over a third overtone if you wanted stability. I have tried several fifth overtone circuits and they left much to be desired (compared to third overtone results).

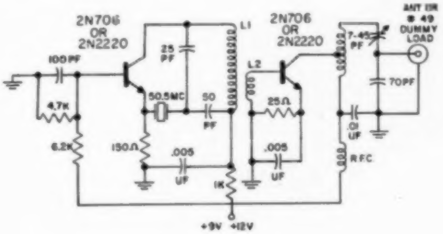


FIG. 2

L_1—¼" dia. 7T #24
L_2—2T at cold end of L_1
L_3—6T Airdux 608 (B&W 3010) CT
RFC—20T #26 on 1W resistor

Actual working 50.5 mc transmitter built and used here to describe use of RF meter and matching.

So in going to 2 meters, I personally recommend using a 24 mc crystal and tripling then doubling or a 36 mc crystal, doubling then doubling to two meters. Meshna and other surplus houses have overtone crystals cheap enough that the savings in crystal alone will buy another transistor.

Beware of these bargain transistors. I have ordered some so called 100 mc types (up to 1 watt) and none would even work on the CB band. They wound up in audio stages. My favorite transistors based on price and results are the Texas Instruments or Motorola 2N706, the Amperex 2N2287 and 2N2786 (which is good for ½ watt at 50 mc and around 300 to 400 mw at 2 meters) and the Texas Instruments or Motorola 2N1143. These are hard to beat if you are interested in vhf. They can be bought at Newark Electronics in Chicago.

Again I urge you to write to the transistor manufacturers for design reports and vhf circuitry if you are interested in vhf.

. . . KØVQY

A Beast for Ten

Mike Schwartz WA2WYJ
42 65 Kissena Blvd.
Flushing 55, N. Y.

When an average ham is on the golf course he may wonder how ten meters is doing. Well, he can't reach into his pocket and pull out a communications receiver covering ten meters—unless he has this "thing" I am about to describe.

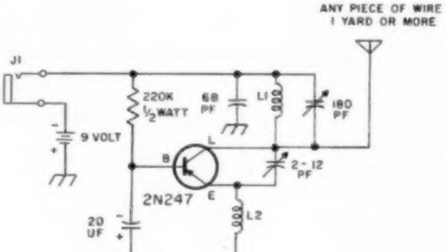
Any ham or swl who can solder should be able to throw this thing together in less than an hour. The circuit is a simple super-regen utilizing a common 2N247 PNP transistor, which you can probably pick up for 2 or 4 bits.

If you were to go out and buy all the parts they would probably cost you about $2.00 (a good investment), but even if you have a sick junkbox the price will probably go down to under a buck.

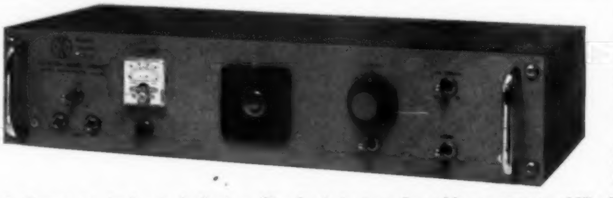
The only thing to watch when constructing the receiver is to keep all leads as short as possible.

Operation of this "Beast for Ten Meters" is like any other super-regen. Receiver tuning is adjusted by C3 while feedback capacitor C4 is the sensitivity control. Adjust C4 until you hear a smooth hiss and listen to all those ten meter stations boom in. Then jump into the car, go home, only to find that the band died. . .

. . . WA2WYJ



L_1 24T #22 C.T. ¼" form
L_2 75 uh TV peaking coil



TELEWRITER
MODEL "L"
FREQUENCY
SHIFT
CONVERTER

$199 (dual eye indicator)
$279 (CR tube indicator)
$14.50 cabinet

Audio input. Scope or dual eye indicator. Plug-in inductors for wide or narrow shift. Axis restorer & Limiter can be switched in or out of circuit, to suit conditions of fading or interference. Copies on Mark only or Space only automatically Mark hold circuit. Loop & Bias supply for optional polar relay for keying transmitter. Keying tube keys magnet. Terminals on chassis for external keying relay & scope indicator.

ALLTRONICS-HOWARD CO., Box 19, Boston 1, Mass.

(W2NSD from page 4)

it and becloud the issue by saying that their objective was to form a coalition of national amateur societies in this hemisphere. Yes, that is true . . . but they wanted this coalition to be under IARU (ARRL) leadership . . . and they were flatly turned down.

Next the League turns to WA2USA. They mention that WA2USA is now off the air. They do not seem to feel it necessary to bring into their discussion why WA2USA was necessary in the first place or the hundreds (perhaps thousands) of dollars that they spent forcing WA2USA off the air. Will the ARRL ever explain to its members why K2US was taken from a prominent spot on the ground floor and thrown up into the attic of the Coca-Cola pavilion? Can they deny that this happened when copies of the correspondence are in the hands of their own directors? Can they deny that they have spared no expense in trying to either take over or get rid of WA2USA?

If you are really interested in much of the inside story of ARRL's K2US then you must read the June issue of The Monitor. This one article is worth a two years subscription (2 yrs. $2.25, Monitor, Box 4133, Dallas, Texas 75208). Each issue of Monitor is about the equivalent of ten pages of 73, all devoted to discussions of the political aspects of amateur radio.

Now . . . speaking of lies . . . the ARRL letter states that the League's General Council was active in the Denver tower case "more than a year ago." Yet the fellow involved wrote recently, "This is the irony . . . in any discussion with any amateur anyplace regarding the lawsuit, the first question invariably asked of me is this one: 'What is ARRL doing to help you?' I am forced to tell them the facts: Nothing."

ARRL June VHF QSO Party

The name "QSO Party" does not do justice to this contest. This is the biggest and most hard fought VHF contest of the year. Many clubs work for months to be ready for this

(Turn page)

Subscribe to 6up
Devoted exclusively
to VHF
73 Peterborough, N. H.

CO-ax connectors LOWEST PRICES
PL-259, SO-239, choice .... 35c ea; 12/$3.75
M-359* ..... 39c, 3/$1.10; PL-258 ..... 65c, 5/$3.00
double male—DON'T BIND .... 89c ea, 5/4.25
M-358 "T" .... $1.95; CH 259 ..... 95c ea, 5/$4.50
J-102* one hole chas. female .... 29c; 4/$1.10
UG-175/U or UG-176/U, reducers. .... 11c. 10/$1
UG-21/U, N male ... 35c, 3/$1. UG-88/U 69c
UG-290/U ..... 69c, 3/$1.95; *clean, ... 29c; 4/1.10
UG-274B/U, BNC "T" .... $1.00; 5 for $4.75
BLITZ BUGS, type #LAC-1 .... $3.75 each
Co-ax feed thru capacitors, 5 mfd 50 v DC, 40 amps$1.95 each.
*means remove from used equipment
Hamfest Schedule: Aug. 2, 6 Meter, Frankfort, Ill.; Aug. 9, Hamfesters, Santa Fe Park, Ill.; Aug. 16, Swap & Shop Picnic, Phillips Park, Aurora, Ill.
B C Electronics
Telephone 312 CAlumet 5-2235
2333 S. Michigan Ave. Chicago, Illinois 60616

ALL BAND TRAP ANTENNA !

Reduces Interference and Noise on All Makes Short Wave Receivers. Makes World Wide Reception Stronger. Clearer on All Bands!

For ALL Amateur Transmitters. Guaranteed for 500 Watts AM 1200 SSB Pi-Net or Link Direct Feed. Light, Neat, Weatherproof.

Complete as shown total length 102 ft. use Coax RG59U or balanced twinline. Hi-impact molded resonant traps. (Wt. 3 oz. 1" x 5" long). You just tune to desired band for beamlike results. Excellent for ALL world-wide short-wave receivers and amateur transmitters. For NOVICE AND ALL CLASS AMATEURS! NO EXTRA TUNERS OR GADGETS NEEDED! Eliminates 5 separate antennas with excellent performance guaranteed. Inconspicuous for snooty neighborhoods! NO HAYWIRE HOUSE APPEARANCE! EASY INSTALLATION!
80-40-20-15-10 meter bands. Less F.L. $13.95
40-20-15-10 meter bands. 54-ft. ant. (best for swl's) less F.L. $12.95
Feedlines: (specify) for Pi-Net output 90 ft. RG59U. $5.00 extra
For Link coupling — 96 ft. balanced twinline .... $2.00 extra
SEND ONLY $3.00 (cash, ck., mo) and pay postman balance COD plus postage on arrival or send full price for postpaid delivery. Complete installation & technical instructions furnished. Free information on many other 160-6 meter antennas.
Available only from:
WESTERN RADIO — Dept. A7-8 — Kearney, Nebraska

NEW*SEMI-CONDUCTORS**
PNP—2N63 2N64, 2N362, 2N381, 2N382, 2N383, 2N404, 2M1681, 2N1706, 2N1008, 2N1966, 807, 903V, 3879 .... 3/$1.00
PNP—2N77, 2N207b, 2N274, 2N284, 2N356a, 2N398a, 2N525, 2N526, 2N600, Dynaquads T/1595, 2SB171b, 2SA101aa 50c
NPN—2N147, 2N214, 2N357a, 2N377a, 2N385a, 2N388, 2N558, 2N679, 2N439, 2N1000, 2N1302, 2N1304, 2N1473, 2N1605 .... 50c
PNP—Power, 2N173, 2N441, 2N442, 2N443, 2N540a, 2N1011, 2N2048, 2N705, ST4153, V.H.F. $1.25
PNP—Power, 2N176, 2N235a, 2N255, 2N307a, 2N1283, 2N1227 .... 60c
PNP—2N456 T/I, 2N533 Delco $2.50
DeLuxe Transistor Ignition System, 6-12 volt negative grd., Complete Tungsol Unit, factory packed, with instructions $21.95
Above are: R.C.A., Sylvania, T/I, Tungsol, G.I., Clevite, Philco, Delco, Motorola, etc.
DIODES
Germanium: 1N34a, 1N54, 1N80, 1N90, 1N126, TS4b, CTP-565 .... 12/$1.00
Silicon: 1N91, 1N181, 1N217, 1N537, PS770, SG2103, 1N411 1N92 .... 30c
1N483b, 1N484, 1N628, GP150, 18 Amp. Motorola 60c
Zeners: SV3372, 1½ V; 1N429—6.2 V; HB2—18V 30c
12 volt—1 watt; SCR 3 amp. 100PIV $1.00
1N2840b, 1N2843b, Motorola, TO 3 case $5.00
ELECTROLYTICS & TANTALYTICS
8 assorted; all popular values, sub-min. U.S.A. .... 8/$1.00
10 asstd; Tantalytics, "Fansteel, T/I, Sprague" .... 10/$2.00
TRANSFORMERS
Driver, Interstage, & Output, C.T., Sub-min. ...... 3/$1.00
Filament, 24 volt sec. Pri 115 VAC, 60 cy $1.25
C.B. Patch transformer, 4 watts $1.50
455 Kc, Osc. I.F., center tapped ½x⅜, all stages 4/$1.00
Volume Controls with switch, sub-min., 2000, 2,500, 5K, 10K .... 3/$1.00
Speakers; sub-min.; 8 ohms output, 100 ohms output .. $1.00
Speakers; Tweeters 3½ inch $1.50
Variable capacitors, ¾x¾" superhet, plastic R/C 75c
Circuit breakers, push-button 25c
Tiny switches; SPST, miniature 25c
Pin jacks, pin plugs, "H.H. Smith", red, black, green 10c
Adapters; RCA plug to PL 68, PL 55 .... 50c
P.C. Boards, loaded with transistors, components, etc. T/I .... 3/$1.00
20K Precision wire-wound "Helipot" 5% tol. min. $1.50
Transistor push-button terminal posts, gold-plated 5/$1.00
"Turner" Model 80 microphone $8.95
Write for Free Catalog
Minimum order $3.00 prepaid
Postage free in U.S.A.
TRANSISTORS UNLIMITED COMPANY
Post Office Box 442, Great Neck, L. I., N. Y.
Warehouse & Office
462 Jericho Turnpike, Mineola, N. Y.
516-PI 7-7221

So in going to 2 meters, I personally recommend using a 24 mc crystal and tripling then doubling or a 36 mc crystal, doubling then doubling to two meters. Meshna and other surplus houses have overtone crystals cheap enough that the savings in crystal alone will buy another transistor.

Beware of these bargain transistors. I have ordered some so called 100 mc types (up to 1 watt) and none would even work on the CB band. They wound up in audio stages. My favorite transistors based on price and results are the Texas Instruments or Motorola 2N706, the Amperex 2N2287 and 2N2786 (which is good for ½ watt at 50 mc and around 300 to 400 mw at 2 meters) and the Texas Instruments or Motorola 2N1143. These are hard to beat if you are interested in vhf. They can be bought at Newark Electronics in Chicago.

Again I urge you to write to the transistor manufacturers for design reports and vhf circuitry if you are interested in vhf.

. . . KØVQY

A Beast for Ten

Mike Schwartz WA2WYJ
42 65 Kissena Blvd.
Flushing 55, N. Y.

When an average ham is on the golf course he may wonder how ten meters is doing. Well, he can't reach into his pocket and pull out a communications receiver covering ten meters—unless he has this "thing" I am about to describe.

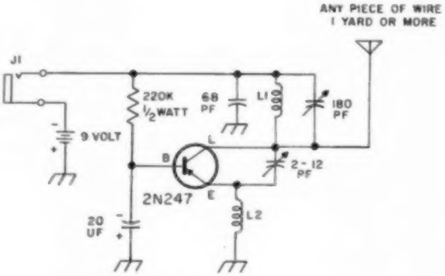
Any ham or swl who can solder should be able to throw this thing together in less than an hour. The circuit is a simple super-regen utilizing a common 2N247 PNP transistor, which you can probably pick up for 2 or 4 bits.

If you were to go out and buy all the parts they would probably cost you about $2.00 (a good investment), but even if you have a sick junkbox the price will probably go down to under a buck.

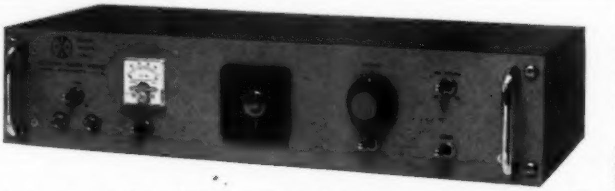
The only thing to watch when constructing the receiver is to keep all leads as short as possible.

Operation of this "Beast for Ten Meters" is like any other super-regen. Receiver tuning is adjusted by C3 while feedback capacitor C4 is the sensitivity control. Adjust C4 until you hear a smooth hiss and listen to all those ten meter stations boom in. Then jump into the car, go home, only to find that the band died. . .

. . . WA2WYJ



L_1 24T #22 C.T. ¼" form
L_2 75 uh TV peaking coil



TELEWRITER
MODEL "L"
FREQUENCY
SHIFT
CONVERTER

$199 (dual eye indicator)
$279 (CR tube indicator)
$14.50 cabinet

Audio input. Scope or dual eye indicator. Plug-in inductors for wide or narrow shift. Axis restorer & Limiter can be switched in or out of circuit, to suit conditions of fading or interference. Copies on Mark only or Space only automatically Mark hold circuit. Loop & Bias supply for optional polar relay for keying transmitter. Keying tube keys magnet. Terminals on chassis for external keying relay & scope indicator.

ALLTRONICS-HOWARD CO., Box 19, Boston 1, Mass.

(W2NSD from page 4)

it and becloud the issue by saying that their objective was to form a coalition of national amateur societies in this hemisphere. Yes, that is true . . . but they wanted this coalition to be under IARU (ARRL) leadership . . . and they were flatly turned down.

Next the League turns to WA2USA. They mention that WA2USA is now off the air. They do not seem to feel it necessary to bring into their discussion why WA2USA was necessary in the first place or the hundreds (perhaps thousands) of dollars that they spent forcing WA2USA off the air. Will the ARRL ever explain to its members why K2US was taken from a prominent spot on the ground floor and thrown up into the attic of the Coca-Cola pavilion? Can they deny that this happened when copies of the correspondence are in the hands of their own directors? Can they deny that they have spared no expense in trying to either take over or get rid of WA2USA?

If you are really interested in much of the inside story of ARRL's K2US then you must read the June issue of The Monitor. This one article is worth a two years subscription (2 yrs. $2.25, Monitor, Box 4133, Dallas, Texas 75208). Each issue of Monitor is about the equivalent of ten pages of 73, all devoted to discussions of the political aspects of amateur radio.

Now . . . speaking of lies . . . the ARRL letter states that the League's General Council was active in the Denver tower case "more than a year ago." Yet the fellow involved wrote recently, "This is the irony . . . in any discussion with any amateur anyplace regarding the lawsuit, the first question invariably asked of me is this one: 'What is ARRL doing to help you?' I am forced to tell them the facts: Nothing."

ARRL June VHF QSO Party

The name "QSO Party" does not do justice to this contest. This is the biggest and most hard fought VHF contest of the year. Many clubs work for months to be ready for this

(Turn page)

Subscribe to 6up

Devoted exclusively

to VHF

73 Peterborough, N. H.

CO-ax connectors LOWEST PRICES

PL-259, SO-239, choice .... 35c ea; 12/$3.75
M-359* .... 39c, 3/$1.10; PL-258 .... 65c, 5/$3.00
double male—DON'T BIND .... 89c ea, 5/4.25
M-358 "T" .... $1.95; CH 259 .... 95c ea, 5/$4.50
J-102* one hole chas. female .... 29c; 4/$1.10
UG-175/U or UG-176/U, reducers .... 11c. 10/$1
UG-21/U, N male .... 35c, 3/$1. UG-88/U 69c
UG-290/U .... 69c, 3/$1.95; *clcan, ... 29c; 4/1.10
UG-274B/U, BNC "T" .... $1.00; 5 for $4.75
BLITZ BUGS, type #LAC-1 .... $3.75 each
Co-ax feed thru capacitors, 5 mfd 50 v DC, 40 amps$1.95 each.
*means remove from used equipment
Hamfest Schedule: Aug. 2, 6 Meter, Frankfort, Ill.; Aug. 9, Hamfesters, Santa Fe Park, Ill.; Aug. 16, Swap & Shop Picnic, Phillips Park, Aurora, Ill.

B C Electronics
Telephone 312 CAlumet 5-2235
2333 S. Michigan Ave. Chicago, Illinois 60616

ALL BAND TRAP ANTENNA !

Reduces Interference and Noise on All Makes Short Wave Receivers. Makes World Wide Reception Stronger. Clearer on All Bands!

For ALL Amateur Transmitters. Guaranteed for 600 Watts AM 1200 SSB Pi-Net or Link Direct Feed. Light, Neat, Weatherproof.

Complete as shown total length 102 ft. use Coax RG59U or balanced twinline. Hi-impact molded resonant traps. (Wt. 3 oz. 1" x 5" long). You just tune to desired band for beamlike results. Excellent for ALL world-wide short-wave receivers and amateur transmitters. For NOVICE AND ALL CLASS AMATEURS! NO EXTRA TUNERS OR GADGETS NEEDED! Eliminates 5 separate antennas with excellent performance guaranteed. Inconspicuous for snooty neighborhoods! NO HAYWIRE HOUSE APPEARANCE! EASY INSTALLATION!
80-40-20-15-10 meter bands. Less F.L. $13.95
40-20-15-10 meter bands. 54-ft. ant. (best for swl's) less F.L. $12.95
Feedlines: (specify) for Pi-Net output 90 ft. RG59U. $5.00 extra
For Link coupling — 96 ft. balanced twinline .... $2.00 extra
SEND ONLY $3.00 (cash, ck., mo) and pay postman balance COD plus postage on arrival or send full price for postpaid delivery. Complete installation & technical instructions furnished. Free information on many other 160-6 meter antennas.
Available only from:
WESTERN RADIO — Dept. A7-8 — Kearney, Nebraska

NEW*SEMI-CONDUCTORS**

PNP—2N63 2N64, 2N362, 2N381, 2N382, 2N383, 2N404, 2M1681, 2N1706, 2N1008, 2N1966, 807, 903V, 3879 .... 3/$1.00
PNP—2N77, 2N207b, 2N274, 2N284, 2N356a, 2N398a, 2N525, 2N526, 2N600, Dynaquads T/1595, 2SB171b, 2SA101aa 50c
NPN—2N147, 2N214, 2N357a, 2N377a, 2N385a, 2N388, 2N558, 2N679, 2N439, 2N1000, 2N1302, 2N1304, 2N1473, 2N1605 .... 50c
PNP—Power, 2N173, 2N441, 2N442, 2N443, 2N540a, 2N1011, 2N2048, 2N705, ST4153, V.H.F. $1.25
PNP—Power, 2N176, 2N235a, 2N255, 2N307a, 2N1283, 2N1227 .... 60c
PNP—2N456 T/I. 2N533 Delco $2.50
DeLuxe Transistor Ignition System, 6-12 volt negative grd., Complete Tungsol Unit, factory packed, with instructions $21.95
Above are: R.C.A., Sylvania, T/I, Tungsol, G.I., Clevite, Philco, Delco, Motorola, etc.

DIODES

Germanium: 1N34a, 1N54, 1N80, 1N90, 1N126, TS4b, CTP-565 .... 12/$1.00
Silicon: 1N91, 1N181, 1N217, 1N537, PS770, SG2103, 1N411 1N92 .... 30c
1N483b, 1N484, 1N628, GP150, 18 Amp. Motorola 60c
Zeners: SV3372, 1½ V; 1N429—6.2 V; HB2—18V 30c
12 volt—1 watt; SCR 3 amp. 100PIV $1.00
1N2840b, 1N2843b, Motorola, TO 3 case $5.00

ELECTROLYTICS & TANTALYTICS

8 assorted; all popular values, sub-min. U.S.A. .... 8/$1.00
10 asstd; Tantalytics, "Fansteel, T/I, Sprague" .... 10/$2.00

TRANSFORMERS

Driver, Interstage, & Output, C.T., Sub-min. .... 3/$1.00
Filament, 24 volt sec. Pri 115 VAC, 60 cy $1.25
C.B. Patch transformer, 4 watts $1.50
455 Kc. Osc. I.F., center tapped ½x⅜, all stages .... 4/$1.00
Volume Controls with switch, sub-min., 2000, 2,500, 5K, 10K .... 3/$1.00
Speakers: sub-min.; 8 ohms output, 100 ohms output $1.00
Speakers; Tweeters 3½ inch $1.50
Variable capacitors, ⅝x¾" superhet, plastic R/C 75c
Circuit breakers, push-button 25c
Tiny switches; SPST, miniature 25c
Pin jacks, pin plugs, "H.H. Smith", red, black, green 10c
Adapters; RCA plug to PL 68, PL 55 .... 50c
P.C. Boards, loaded with transistors, components, etc. T/I .... 3/$1.00
20K Precision wire-wound "Helipot" 5% tol. min. $1.50
Transistor push-button terminal posts, gold-plated .... 5/$1.00
"Turner" Model 80 microphone $8.95

Write for Free Catalog
Minimum order $3.00 prepaid
Postage free in U.S.A.

TRANSISTORS UNLIMITED COMPANY
Post Office Box 442, Great Neck, L. I., N. Y.
Warehouse & Office
462 Jericho Turnpike, Mineola, N. Y.
516-PI 7-7221

effort. In the past the Waltham Amateur Radio Club (Mass.) has done a sterling job in this contest by driving an unbelievable amount of equipment and antennas to the top of Pack Monadnock, a mountain just a few miles inside the New Hampshire border.

This year the club decided to set up on Grand Monadnock and take advantage of the 73 Villa there . . . and its antennas. The work of installing the equipment started five weeks before the contest, with weekend visits by three or four club members. The last connections were made some two hours after the contest had started with everyone rushing all over the place trying to get on the air and catch up with the rest of the contesters.

The finished installation was impressive. On six meters they had a Clegg Venus with a kilowatt linear, a Redline converter into an Hammarlund HQ-170 and a choice of a 16 element colinear by Cushcraft fixed tuned toward New York or a five over five by Hi-Par rotatable, both on a Rohn 60 foot tower. On two meters a 6N2 drove PP-4-125A's to a kilowatt, a Tapetone converter fed a National NC-303, and the antennas were a choice of a fixed on New York area 192 element colinear-yagi beam by Cushcraft or a 48 element rotatable (Ham-M) Cushcraft colinear-yagi on a 120 foot KTV tower. W1OOP brought in his 220 432 and 1296 mc gear which were hooked to a 32 element Cushcraft 220 mc colinear on a 50 foot Rohn tower with a CDR TR-44 rotator or a 96 element Cushcraft colinear-yagi for 432 mc on the same mast. Hank brought his own 1296 mc dish which he aimed out the window for two contacts, the furthest at about 55 miles.

All bands remained closed for the duration of the contest except for a few minutes when six cracked long enough for a couple Florida sections to be worked. Even so contacts were made down into Delaware and up into Ontario on two meters. Over 300 contacts in 16 sections were made on two; over 350 on six meters. On 220 mc nine sections were contacted and ten on 432 mc.

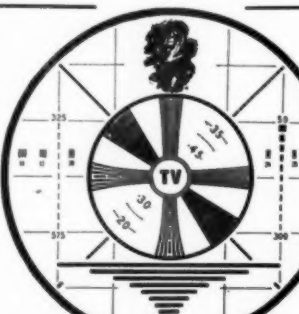
The Waltham effort included nine operators: K1JCC, W1KSI, W1DDF, W1DDN, W1LKK, W1OOP, W2MSN, W1NUL, W1EGE. Some operated most of the time, some kept things running, some slept, and one kept the victuals in good supply. I seriously doubt if there was a one that did not have a ball.

Field Day Lull

Though I did not submit a log for Field Day this year, I did spend quite a bit of time around the six and two meter bands in an effort to give as many FD stations as possible a contact with New Hampshire. There wasn't much action. I don't think I've heard a quieter Field Day. Apparently this was not only true of New England for I've received letters from other parts of the country commenting on this phenomenon.

In talking with members of clubs that have been quite active during past Field Days, the reason given for skipping this year was member apathy about the League which has translated itself into a "why should I participate in an ARRL event after what they did to me?"

I know it is difficult to put the League into perspective after all these years. Sure, I grew up on THE Handbook, W1AW, and QST too. For quite a few years it almost seemed as if the ARRL *was* ham radio. I know it is like that with tens of thousands of other hams too. The problem with this is that when disillusionment comes, this love of ARRL turns to hate of ARRL. And hate doesn't allow perspective about the good points of the League. This is one of the reasons why I think the "Amateur's Code" is so poor. It deifies the League and sets it up to be hated when the first blunder is detected.



YOUR ONE COMPLETE SOURCE
for HAM-TV, ATV, CCTV
Equipment . . .

Test Monotrons type
1698 only $9.95 pp

FREE FLYER
#771 . . . Full of
Bargains!!!!!

CATALOG 50c
#1273 . . . "How To Build
Low Cost TV Cameras"

Catalog #1273 plus
LARGE Size schematic $1.50

Phone: 203-875-5198

VIDICONS: $34.50 up
1" electromagnetic or
2" electrostatic, your
choice: Grade C: $34.50
Grade B: $60.00
Grade Ham A: $100.00
All types Ham-TV
equipment Bought-Sold-
Traded . . .
WRITE!

DENSON
ELECTRONICS
CORP.

Rockville, Connecticut

Field Day should be kept alive. It is an invaluable test of our ability to provide emerengcy communications . . . and it is a strong cohesive event in that it requires considerable effort of a group nature. Let's not let our annoyance with the actions of a small group of League officials spoil ham radio for us. For every bad thing that these fellows have done, the League has performed many good deeds. When you read Huntoon's "Dirty Letters" just remember that he is one fellow . . . and that downstairs are fellows spending their working days sorting out DX QSL's for you, sending out films for club meetings, and filling out RCC certificates. When you hear about Hoover moving heaven and earth to put WA2USA off the air remember Bob White up in his office checking over thousands of submitted QSL's, looking for forgeries and cheating, before giving credit for the Honor Roll. Remember Lou McCoy and his fine work for the Novices.

Let's bring Field Day back next year, OK?

Bill Orr, Leader or Demagog?

A demagog is defined as a leader who uses the passions and prejudices of the populace for his own interest.

If you read much I don't have to tell you about Bill W6SAI. He has been writing articles for ham magazines for years . . . interesting articles. He is an owner (half owner, I believe) in Radio Publications, the largest publishers of books for hams, excepting the ARRL. He is the writer of the Editors and Engineers Radio Handbook . . . and he works for Eimac.

Since joining Eimac about five years ago, Bill has taken a very active interest in the ARRL and is given the major credit by many for the seating of Herb Hoover as president of the League. With the submission of RM-499 by the League, Bill rushed into action, sending letters to, I suspect, thousands of amateurs seeking their support of 499. He has written articles on 499 for 73, QST and CQ. When we held our poll on 499 back in March a curiously large number of specially printed postcards came from his area.

His articles on 499 have brought letters to me complaining that he has substituted emotion for facts and has otherwise been devious in his support of this proposed legislation. I too have been critical of Bill for this reason.

Those of you who do believe that RM-499 is a good thing are probably gnashing your teeth. Gnash, but read on. I want you to read Bill's petition in support of RM-499 that he

FREE Catalog

OF THE WORLD'S FINEST
ELECTRONIC GOV'T
SURPLUS BARGAINS

HUNDREDS OF TOP QUALITY ITEMS—Receivers, Transmitters, Microphones, Inverters, Power Supplies, Meters, Phones, Antennas, Indicators, Filters, Transformers, Amplifiers, Headsets, Converters, Control Boxes, Dynamotors, Test Equipment, Motors, Blowers, Cable, Keyers, Chokes, Handsets, Switches, etc., etc. Send for Free Catalog—Dept. 73.

FAIR RADIO SALES
2133 ELIDA RD. • Box 1105 • LIMA, OHIO

RT82/APX6 Get on 1215-1296 mc the EASY way	NEW	24.75
TS726/UPM8 Tests APX6. W/27 Tubes, 10 Diodes.	GOOD	14.50
COAX CABLE Special. Connects UPM8 to APX6	EX	1.50
RT18/ARC1 100-156 mc X'ceivr. 832A final	EX	22.75
MT230/ARC Mounting for ARC1, ARC4 and ARC12	EX	2.35
RT58/ARC12 225-350 mc W/42 Tubes, two 2C39A's	EX	29.75
C45 Control Box for ARC1 and ARC12	GOOD	1.25
ARN6 X'ceivr 100-1750 kc. Four band superhet	EX	19.25
MT273/ARN6 Mounting, dual control type w/relay	EX	2.85
MT274/ARN6 Mounting, single control type	EX	2.35
AS313B/ARN6 Antenna Station seeking loop	GOOD	8.90
C403A/ARN6 Contr Box Binding Post connections	EX	6.75
C4/ARN7 Contr Box for ARN7 or convert for ARN6	NEW	2.75
T465/ALT7 168-352mc continuous. 100W min o'put	EX	22.50
Schematic for T465/ALT7 with parts values		1.00
6161 Tube 100 watts to 900mc, good to 2000mc	EX	7.25
Socket, Air System Type, for 6161 tube	EX	1.25
SWR Bridge 200W 10-1000mc W/diodes and meter	EX	8.25
Blower, Axivane Type, 60 cfm, 12-24V AC/DC	EX	6.75
FT243 XTAL SET of 120, 5675kc thru 8650 kc in 25 kc increments. US tested & packed		120/17.75
HV Probe 50kv insulation, 500 meg series res	NEW	2.45
RE2/ARC5 Ant Relay W/Meter & Vacuum Capacitor	EX	1.85
TS12 SWR Meter 9305-9445 mc W/60 cycle supply	EX	19.75
IP223/APS38 Sweep Amplifier 4 tubes, 2-807W's	NEW	6.75
ID59/APA11 W/3BP1 & 16 tubes EX for Panadapt.	EX	17.50
APX1 less tubes. A Warehouse of Parts. 30 lbs.	GD	2.75
TN8 or **TN90** Tuning unit for APX1 w/3 tubes	GD	1.00
TS155C Signal Generator, 2700-3400 mc. W/Book	NEW	75.00
APN1 420mc Xceiver W/Tubes, Wobulator, Dynamotor	GD	3.85
TS10 Tests 40-400 foot APN1 range	GOOD	10.00
TS59 Tests 400-4000 foot APN1 range	GOOD	12.50
PRS-3 '53 Model. Locates Pipe & Sunken Metal	NEW	37.50
Noise Filter Sprague JX51M or Potter B110	NEW	1.00

E. C. HAYDEN **BOX 294 Bay Saint Louis
Mississippi**

Shipment: FOB Bay Saint Louis... Terms: Net, Cash.

"RW" August Bargains

JENNINGS VACUUM VARIABLE CAPACITOR—Type UCS 10-300 mmf, 15KV, with 20 turn multiturn dial & FM2 flange mount. New-removed from new equipment. **$49.50**

AUTOMATIC KEYER KY-65/ARA-26 Easily converted to Automatic CQ'er. Xlnt for band warming, contest & etc. See "73" Apr. 62 for conversion details. Used, Xlnt. **$ 3.50**

HIGH VOLTAGE PROBE—Handles up to 50KV with VOM or VTVM. Has 500 megohm hi-voltage resistor. Brand new **$ 2.95**

TWO METER FIELD STRENGTH METER—Calibrated 100-156 MC Battery operated 1½v & 45v. Used, Xlnt less batteries .... **$ 6.95**

LAZY MAN'S Q-5er—Navy Radio Beam Filter for CW 100cy bandpass. Single Signal Selectivity the easy way. New .... **$ 2.40**

MN-26C BENDIX RDF RECEIVER 200-1500KC in 3 bands. Two RF Amp, 112.5KC IF, AVC & BFO with 12 tubes 28vDC dynamotor & schematic. Used good **$14.95**

ARC-1 TRANSCEIVER 100-156MC—10 channel Xtal controlled, PNL, AVC & Squelch. Complete with 29 tubes, IF Xtal, 24vDC dynamotor & orig. Schematic. Used, Xlnt. **$29.95**

Send money order or check with order—PLEASE INCLUDE POSTAGE—Excess promptly refunded. Minimum C.O.D. $10.00 with 25% Deposit

R. W. ELECTRONICS, INC.

2430 So. Michigan Ave. **Dept. 378**
Chicago, Illinois 60616 **Phone CAlumet 5-1281**

sent to the FCC. I want you to read it slowly and thoughtfully, paragraph by paragraph.

Some people feel that RM-499 is an open sore that should be left alone. One manufacturer cited this when he cancelled his advertising in 73 (Commaire Products). A more apt comparison might be with a time bomb. However, right now, let's bypass the content and argument of 499, and look at Bill's petition.

Please note that nowhere in Bill's petition has he offered even the slightest support for 499 on its own merits. He is asking the FCC to pass this legislation because if they don't the League will be damaged. Where was Bill when the League was drafting 499 and setting themselves up for such a disaster? Bill, who has been fighting hard for the passage of 499, is saying, in his own way, that the FCC should not deliberate on the content of RM-499, that they should pass it because the ARRL submitted it.

Now, please read . .

Petition in Support of RM-499

1. Radio amateurs today are locked in a struggle with themselves, the outcome of which will determine the future of the Amateur Radio Service. As radio amateurs reflect a cross-section of society, so does Amateur Radio Service reflect in miniature the problems that beset society; the painful civil disobedience in Mississippi, Birmingham, and Dallas, Texas remind us of dark and violent emotions inherent in individuals otherwise judged to be members of a civilized society. Just as birth does not guarantee judgment or compassion, as citizenship does not guarantee reason or intelligence so neither does possession of a radio amateur license guarantee wisdom or forebearance.

2. Within the ranks of amateur radio exist voices of dissention and intolerance, offering simple, easy solutions that entail no responsibility but that appeal to unreasoning minds. These voices are now attempting to tear asunder the fabric of amateur radio by attacking the American Radio Relay League and the 40 years of order and tradition it represents.

3. It is my firm belief that an adverse decision on the ARRL Incentive License proposal (RM-499) will be interpreted as a vote of no confidence in the American Radio Relay League, and will represent a rebuff to all serious radio amateurs seeking to improve the Amateur Radio Service, in the best tradition of public interest. Such a rebuff will cause the ARRL to recoil in confusion, and the ensuing shock will be most damaging if not fatally injurious to this organization, nullifying it as an effective body of amateur opinion and guidance.

4. Into the ensuing void will climb those self-acclaimed, irresponsible dissenters who captivated by their own clamor, have slandered the ARRL in a manner ignominious and slurring to the very character of amateur radio. These sowers of discontent and half-truths who violently oppose the League at every opportunity stand, ever-ready in the wings, alert for the first signs of retreat from reason, impatient to burst forth, frothing pious platitudes for the unthinking, well-meaning but short sighted radio amateurs who, in their unwisdom, place private comfort above public interest. The ascendency of these forces will be a melancholy experience for those who guide and for those who exert police power over the Amateur Radio Service.

5. In closing, permit me to refer to the last, unspoken message of President Kennedy, to be delivered in Dallas, Texas, Friday, November 22, 1963: "There will always be dissident voices heard in the land, expressing opposition without alternatives, finding fault but never favor, perceiving gloom on every side, and seeking influence without responsibility."

6. I commend these sober words to you, and hope that in your deliberations you will note and place aside the voice of those self-seeking radio amateurs who stand ready to dismantle the philosophy of self-advancement and education, of discovery and invention, and of enlightment without which amateur radio is nothing. It is in the public interest (some 200,000,000 strong) that the Amateur Radio Service remain a leader and model of good citizenship and a beacon for those intellectually curious and science minded children of the coming generation. The desire of a portion of the 250,000 radio amateurs to reduce the Amateur Radio Service to agree with their ideas of a comfortable communication hobby is, in my mind, distinctly not in the national interest.

7. I petition the Federal Communications Commission to approve Petition RM-499 with dispatch.

Sincerely yours,
William I. ORR W6SAI

Letter

Dick Martin WA6RMT reminded me that a good answer to (ugh) CQ appeared on the cover of the July 1956 issue of CQ, 3rd cartoon down.

Prints

Rather than carry on long harangues in 73 trying to answer various critics such as Huntoon, Anderson, Cowan, etc., I've taken to writing my answers to criticisms received and printing up a few copies for those that I think will be interested. If you would like to see my answer to some of these smear attacks, I'll be glad to send you a copy of my reply. Please send self addressed stamped envelope with 5c postage on it for each letter.

CUKE . . . my answer to the insulting letters in the July issue of CQ.

WARN . . . a point by point discussion of the June issue of Washington Amateur Radio News, a sort of ARRL-affiliate magazine specially published to fight the Institute of Amateur Radio.

VHFER . . . an answer to an editorial by W8HHS . . . his answer to me, and my further answer to him. Dull.

HUNTOON JUNE 5 DIRTY LETTER . . . a point by point answer of Huntoon's letter to all affiliated clubs, citing his distortions and outright lies.

RTTY Rule Change

The RTTY contingent will be happy to know that the FCC finally has modified the dual identification regulation slightly. Now it is no longer necessary to send the call of the station you are working on CW at the beginning and end of each QSO . . . just your own call. This simplifies things for a code wheel or short tape will permit this CW identification without the necessity of hand keying. This rule holds for amateur television and facsimile also.

Intruders

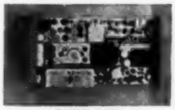
The Institute of Amateur Radio is encouraging a crackdown on non-ham use of our short wave bands. I am happy to report that several amateurs in Atlanta have been sending reports to the FCC of reception of foreign interference. One was identified as a Yugoslavian point-to-point radiotelephone station and the FCC sent a radiogram requesting assistance to Belgrade. Another was identified as Radio Saracay in Ecuador. Quito was notified. A third unwanted signal turned out to be the second harmonic of a station in Mexico City. Mexico was advised.

When you hear intruders in our bands do your best to identify them and then report this to your nearest FCC office. I'd like to hear about any successes. With diligence we can get the great bulk of these intruders out of our bands. . . . Wayne

F. M. SPECIALS

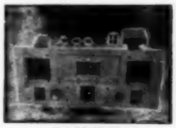
MOTOROLA T44A

Motorola T44A-6 6/12 V DC Power Supply 18 W Transmitter, 2C39 driver and final. 0.8UV receiver, triple conversion, 72MC, 8MC, and 455KC IF frequencies. Furnished with conversion data, crystal information and schematics. $52.50



FMTR-41V

Motorola 41 V, 10W RF, 150MC 10W, Mobile with 2E26 Final. Can be converted to 12V. Instructions & Schematics Furnished $29.95



TT-63/FGC

TT-63A/FGC—Regenerator, Repeater set, capable of receiving teletype writer signals in audio or direct current form having up to 45% distortion and regenerating the signal to have less than 5% distortions. With Diagram. $34.95

General Radio Primary Frequency Standard Model 1100A Syncrometer 1103A, Crystal 1101A, and Multivibrator—P.S. 1102A.
In operating condition (1 x 10-9 stability)
Price $490.00

WRITE FOR FLYER.
SALES TO AMATEURS ONLY

F M SURPLUS SALES COMPANY
1100 Tremont Street
Boston 20, Massachusetts

2-METER STATION

Completely converted ARC-1 surplus transceiver. 25 watts input, plate-modulated AM. Both receive & transmit VFO or xtal controlled. 115-volt power supply built in. Receiver has extra xtal-controlled "guard" channel which can be used to monitor your net frequency while main receiver is tuned to other frequencies. Squelch. Input for ceramic mike. Less xtals & mike. 7¼" h. x 10" w. x 21" deep. Shpg. wt. 75 pounds. $98.50

ARC-1 Power supply kit for converting your ARC-1 yourself. Same as used in set above. Entire supply fits inside ARC-1. Supply is completely isolated from AC line. Includes chassis & all parts. 20 pounds. $19.95

ARC-1 unconverted. With tubes, less dynamotor & xtals. Shpg. Wt. 60 lbs. good used cond. $24.95. 12 uf-1500 vdc. oil-filled capacitors. GE. 3¾" x 4½" x 5½". 7 lbs. Limited quantity. $3.00

Send for our flyer.

Please enclose sufficient money to cover shipping charges. Any excess will be refunded.

JEFF-TRONICS

4791 Memphis Ave. Cleveland, Ohio 44109

(Receiver from page 52)

To maintain a constant *if* bandpass with varying signal conditions, no AGC is applied to either of the 85 kc *if* amplifiers. If AGC was applied to these transistors, output and input impedance changes with collector current would produce a varying bandwidth with varying signal levels.

The output of the 85 kc *if* strip is coupled through the output transformer secondary to the detector circuits.

Detector, AGC, and Noise Limiter Circuits

Separate detectors are utilized for receiving AM and SSB, CW signals. The use of a separate detector on SSB overcomes the problem of nonlinear detection under strong signal conditions.

The AM detector consists of a conventional series diode whose output is fed to a series noise limiter circuit.

The SSB-CW detector consists of Q_9 and Q_{10} operated as a product detector. The output of the *if* strip is coupled to the base of Q_9 which shares a common emitter resistor with Q_{10}. Carrier injection is applied to the base of Q_{10} and in this stage is mixed with the *if* signal developed across the common emitter resistor. Audio, carrier injection oscillator, and *if* appear at the collector of Q_9 and Q_{10}. A low pass filter immediately follows Q_{10} and passes only the audio frequencies to the audio amplifier. The frequency of the carrier injection oscillator, Q_{11}, is variable and may be used as a pitch control when receiving CW signals.

AGC voltage is taken from a point immediately following the diode detector and applied to the base of Q_{17}, the combination AGC amplifier and S meter amplifier stage. To minimize loading of the controlled stages on the AGC line, Q_{17} operates as an emitter follower and provides a low impedance point from which the AGC voltage is derived. The emitter resistor of Q_{17} is variable and functions as an rf gain control if manual gain control is desired. The signal strength indicator, a 0-1 milliamp dc meter, is connected in the collector circuit of Q_{17} and indicates any change in AGC voltage. When using manual gain control, the S meter is switched out of the circuit. This S meter circuit suffers the same limitations that are inherent in all vacuum tube S meter circuits, namely nonlinearity and varying readings on different bands due to gain changes. Since the gain of transistors changes nonlinearly with current, and since changes in input and output impedances with current produce varying losses in the tuned circuits associated with the controlled stages, the design of a linear reading S meter circuit becmes a very difficult, if not impractical, task to undertake. The S meter, therefore, was calibrated to agree with the nonlinear AGC characteristic of the receiver. While the AGC characteristic is nonlinear, a plot of AGC voltage versus signal strength should yield a smooth curve; otherwise, the S meter calibration would be quite random. To achieve this smooth characteristic, it was found necessary to have the gain of all controlled stages changing at approximately the same rate. This was achieved by biasing the emitters of Q_1, Q_2, and Q_4 from the voltage dividers as explained earlier in this paper.

The noise limiter consists of a conventional series diode which is self-adjusting to different incoming signals and was set to clip at approximately 30% modulation.

Audio Amplifier and Power Supply Circuit

The audio amplifier circuit is a conventional Class A, common emitter stage, Q_{12},

Table 1

Band	80	40	20	15	10	All	Units
SSB Sensitivity for 10 db S + N/N						< 0.3	µv
AM Sensitivity for 10 db S + N/N	0.8	0.7	0.8	0.6	0.7		µv
Gain Variation	0 (ref)	−2	−4	−3	−7		db
1st if Image Rejection	60	60	60	50	50		db
2nd and 3rd if Image Rejection						> 60	db
Spurious Response Rejection						> 50	db
Rf Overload at 30% Modulation						30K	µv
Rf Overload at 80% Modulation						15K	µv
AGC Figure of Merit						85	db
IF Bandwidth 6 db Down						1.5-6	kc
Audio Output Power at 10% Distortion						2	watts
No Sig. Current Drain						75	ma
Antenna Input Impedance						50	

driving a push-pull amplifier, Q_{13} and Q_{14}, capable of two watts of output power at 10% harmonic distortion.

The power supply consists of a full wave rectifier and a transistor regulator. Regulated voltage is applied to all stages with the exception of the audio output. Receive standby switching is accomplished by removing the supply voltage from all stages except Q_2, Q_3, Q_6, and Q_{16}. These four stages derive their voltage from an additional regulator diode for the purpose of providing additional frequency stability to the receiver. The regulator transistor operates on both 115 volts ac or 12 volts dc supplies.

The complete circuit of the receiver is shown in Fig. 2. As was stated in the introduction of this article, the objective of the design was to produce a receiver which would compete with today's top-of-the-line vacuum tube receivers. It is felt that this receiver more than meets these requirements. The advantages of transistors over tubes have been known for some time and include such things as reliability and small size. Unfortunately, most advantages carry along with them some disadvantages. In this case, the inability of the receiver to handle extremely large signals without overload might be considered a disadvantage. The large signal handling capability of this receiver was compared with its vacuum tube counterpart and found to be equivalent up to approximately 30 Kμv at 30% modulation. Above this signal level, the transistorized receiver exhibited more spurious responses than that of the vacuum tube receivers measured. This value of signal level is seldom encountered in practice and, therefore, this characteristic should have very little degrading effect on the overall operation of the receiver. The performance obtained from the completed receiver was excellent in every respect. Important performance characteristics of this receiver are listed in Table 1.

. . . Morgan

Attention mobileers: This receiver will give you good results for mobile operation but do not forget to add the standard protection (silicon diode) to the front end transistor or you will have to buy a new one every time you go to a mobile rally. . . . ed

Transistor List

Q_1	TI-365 or 2N2189
Q_2, Q_4	TI-363 or 2N2189
Q_3	TI-395 or 2N2188
Q_5, Q_6, Q_7, Q_8, Q_{19}	TI-364 or 2N2188
Q_9, Q_{10}, Q_{11}, Q_{12}, Q_{15}, Q_{16}, Q_{17}	2N1274
Q_{13}, Q_{14}	TI-369 or TI-368
Q_{18}	2N1304

The TI-numbered transistors will give optimum results. They can be ordered through any Texas Instruments distributor.

AUGUST SPECIAL PRICES for 73-Magazine fans ONLY, so don't tell others. We want to liven up a month that's usually dead. Everything unconditionally guaranteed.

TIME PAY PLAN: Any purchase totalling $100.00 or more send us only 10% for Down Payment!

ALL-BAND SSB RECEIVER BARGAIN: R-45/ARR-7 has 2 stages RF, 2 stages 455 kc IF, separate Local Osc. w/VR AF, S-Meter, Noise-Limiter, Crystal & non-crystal IF Pass in 6 pass selections . . . and now we add PRODUCT DETECTOR in the empty socket left by removal of the reradiation supressor preceding the 1st RF. Goes on when BFO is flipped on, works like a charm! CONTINUOUS TUNING 550 KC to 43 MC! Voice, CW, MCW. With 120/230 v. 50/60 cy power supply, ready to plug in and use. HOT and SHARP! With book 90 lbs fob LA **169.50**
Modified by W6BHR; see page 18, June 73

Same but less the Power Supply fob Los Ang. 139.50

Same, with power supply, less the SSB modification, fob San Antonio, Texas **149.50**

GUARANTEED CONDITION TELETYPE. All came off operating line, all SYNCH. motors. No pwr splies. Clean, oiled, no rust. We will replace all parts you need, except window glass. FREE, if you specify Part Nos., so get the books, too.

Mod. 15 w/keyboard, plus Mod. 14 Typing Reperforator, plus Mod. 14 Transmitter-Distr., all in handy operating console cabinet fob Los Ang. only .. **149.50**

Mod. 19 plus same additions in same Console 169.50

Mod. 14 Trans.-Dist., with cover 37.50
TM11-352 on Mod. 15, 7.50. TM11-2222 on #14TD, 8.50. TM11-2216 on Mod. 19, $12.50. TM11-2223 on #14 Typing Reperforator, $9.00.

ARC-5 Q-5'ER COMMAND RCVR 190-550 kc with 85 kc I.F.'s; have Loop input designed for the DU-1 described below, plus regular antenna input. With splined tuning knob, schematic, pwr sply & control ckt dwgs & connections. Sold the Goodheart way, 100% grtd, each unit ELECTRICALLY CHECKED & RE-ALIGNED!
10 lbs fob Los Angeles, EXCELLENT **14.95**

Electrically same, but less pretty externally, call it Good to Fair **12.95**

Add DIRECTION FINDER To Your Receiver

Navy DU-1 gives TRUE BEARING in 3 seconds! No 180 deg. ambiguity! Goes ahead of your receiver; takes 200-250 v., 16 ma and heater voltage from your receiver. 2 12SKY7's in tuned preamp and phasing circuit, 200 to 1600 KC in 3 bands. Instructions tell how to modify to get Marine Band if desired. Only 7 lbs. net wt. 11" loop, 4¼" azimuth scale. BRAND NEW, with plugs, mount, diagram, instructions **24.50**

LM FREQ. METER is a SIGNAL GENERATOR with uncalibrated output, 125 kc to 20 mc, and also MEASURES UNKNOWN FREQ. in the same range, both with accuracies approx. .01%. Differs from BC-221 in that the 1 mc Crystal is switched out when VFO is ON, but a simple change at the switch enables VFO & Xtl simultaneously; we tell you how. All LM's have AF Mod. but very few BC-221's. Foreign buyers drive price up on BC-221 because Ground Signal books specify it; get LM, w/same accuracy & range, at YOUR price! In exc. cond., electrically checked & unconditionally grtd, w/xtl, matching serial calib. book, plug, schem., pwr sply dwg & connections, list of minor xtl check points, method of eliminating harmonic ambiguity, and much other info.
15 lbs fob Los Ang **49.50**

MAKE POWER SUPPLY for LM's by modifying brand new EAO 60 cy portable power supplies with Instructions and Silicon Diodes we supply.
47 lbs fob San Diego **9.95**

TEST SCOPES GALORE! DuMONT & TEKTRONIX!
Exc. appearance, 100% checked & grtd, w/book.
DuMont #304A, DC-100 kc. 10 mv/cm 139.50
DuMont #401R Rack Scope DC-100 kc 169.50
Tekt. #514A or 514D: DC to 10 mc, 30 mv/cm ... 349.50
Tekt. #514AD, DC-10 mc, 30 mv/cm 395.00
Tekt. #524 special for TV engineers 495.00

WE HAVE MUCH MORE! ASK FOR YOUR NEEDS!

R. E. GOODHEART CO., INC.
Box 1220-GC BEVERLY HILLS, CALIF. 90213
Phones: Area 213, office 272-5707, messages 275-5342.

73 Products and Publications

6UP Magazine. The only fullfledged monthly devoted to VHF. Invaluable to the Technician and the VHF/UHF DX'er and experimenter. Activity reports on all band openings. Wide band FM news. Six meter news. Two meter news . . . 220, 432, 1296 . . . etc. Construction articles, antennas, etc. K5JKX editor. **$2 per year.** Don't miss a single copy of this interesting magazine.

ATV Bulletin. The Amateur Television Experimenter is the only publication devoted to ham-TV. Circuits, operating news, conversions of surplus gear, ads for TV gear, discussions. W0KYQ editor. **$2 per year, published** bimonthly.

Back Issues of 73. All back issues of 73 are available for **50c each except** June 1962 and January 1961, which are unavailable, and Oct-Nov-Dec 1960 issues, which are $1 each. We'll *pay* $1 for a January 1961 or swap for it.

Binders. Bright red leather gold stamped with 73 and year. Specify 1960-1, 1962, 1963, 1964. **$3.00 each.**

Bound Volumes. Only a few left. 1960-1, 1962, 1963. A very few. Beautiful red leather. **$15 each.**

W0KYQ editor. **$2 per year,** published bi-
Impedance Bridge. Full scale construction prints for the bridge described in the August 1961 issue of 73. Comes complete with a reprint of the article. Watch out General Radio! $1.00

SSB Transceiver Schematic—W6BUV. Giant size schematic of the transceiver that appeared in the November 1961 issue of 73. Complete with extra November issue. $1.00

73 Inc

Peterborough, N. H.

Diode Tester

Don Hansen W9ZZH

Need a simple go-no-go diode checker? Fig. 1 shows the schematic of a tester that will check most of the diodes used by radio amateurs. It consists of a 6.3 volt filament transformer, a SPST switch, two 1N34A diodes, and two number 48 or 49 panel lamps. The number 48 and 49 panel lamps have a voltage rating of 2 volts and a current rating of 0.06 amps. The number 48 panel lamp has a screw base and the number 49 panel lamp has a bayonet base.

To test a diode, connect it across the test terminals (observe polarity). Turn the power switch to on. If only lamp I_1 lights, the diode is good. If only lamp I_2 lights the diode is good except it is reversed in polarity. If both I_1 and I_2 light, the diode is shorted. If neither I_1 or I_2 light, the diode is open.

. . . W9ZZH

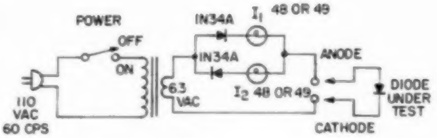
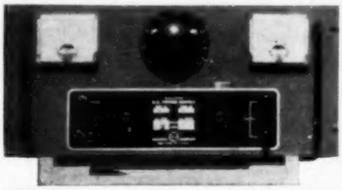


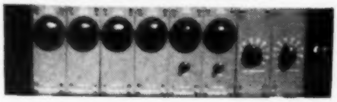
FIG. I

Gonset on CW?

The old Gonset Communicators were fine rigs for AM, but are useless for CW and SSB. However, it's not too hard to modify them so that they will do an adequate job on CW and on sideband signals that aren't too strong. Plug a 6000kc crystal (obtainable from International Crystal in Oklahoma City) into the crystal socket and turn on the spot switch. The 6000 kc carrier will beat against the signal at about 6000 kc, and you can copy the desired signal. Needless to say, the crystal can be anything from 5995 to 6005 kc and still give good results. If desired, the *if* can be peaked about 1.5 kc away from the crystal frequency on a steady carrier for best results.

. . . WA4HWH





Opad KM75 Power supplies 0-32 volts, 5 amps **$40.00**

TS 418A 400-1000 meg signal generators, AM, PM or CW emission **$325.00**

Baird Atomic 162 Glow transfer counters **$100.00**

Baird Atomic 8015 Industrial counters with model 380A supply **$100.00**

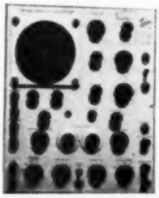
304H Dumont scopes **$75.00**

EFB Electro power supplies 0-32 volts, 4 amps, 0-16, 8 amps **$35.00**

Borg-Warner assembly no. 1462 2.7-3.0 KMC Free running signal gen. **$325.00**

Approximately 17,000 unwound Ferrite memory cores **$12.00**

10 lbs. epoxy resin with catalyst, Type XR-5034 . . . . . . **$6.00**



Tektronix 513D Scopes **$300.00**

Tektronix 514D Scopes **$275.00**

Orders FOB Cambridge, Mass.
Sorry we do not issue catalogs or lists

ELI HEFFRON & SONS, INC.

321-329 ELM STREET **CAMBRIDGE 39, MASS.** **EL 4-8572**

Subscriptions

If you like 73 we'd appreciate your help in getting more fellows to subscribe. The big difficulty is to overcome inertia and actually get them to sit down to get it done. We try to make it as simple as possible on our end. The price is a simple (and low) $4. Our address is simple: 73, Peterborough, N. H.

MASTER ORDER BLANK

73 Subscriptions

Name__________ Call______

1 yr $ 4.00______

Address__________

2 yr $ 7.00______

City______ Zone____ State______ Zip______

3 yr $10.00______

One year subscriptions

LIFE $50.00______

6up $2____ ATV $2____

New sub.______

Renewal sub.______

IoAR Membership 1 yr $10______

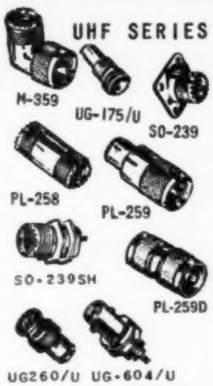
Start with______

Back issues (50c each)__________

INDEX TO ADVERTISERS

To aid you in finding ads which are not running in this issue we have listed the last ad run by each company in 73.

Oct. 63	Aaron
Cover 2	Adcom
Jan. 64	Adirondack
Oct. 63	A & F Electromart
Sept. 63	Alco
Mar. 64	Alcom
Oct. 63	Alden
June 64	Algeradio
25	Alliance
Sept. 63	Allied
84	Alltronics-Howard
July 64	Amateur Elect. Supply
Feb. 63	Amateur Radio Exchange
Nov. 63	Amber
July 63	American Crystal
May 63	Amperex
July 64	Amplidyne
69	Amrad
75	Antenna Specialists
Apr. 63	Arrow Electronics
June 63	Arrow Sales, Cal.
June 64	Arrow Sales, Chi.
July 64	Atlantic
Oct. 63	Badges
Sept. 63	Bald Eagle
73, 85	BC Electronics
July 64	Bell
Apr. 64	Best
Oct. 63	BF
Oct. 61	British Radio
45	Burghardt
39	B & W
Apr. 64	Byron Airpack
67	Callbook
Aug. 63	Candee
June 64	C & H
July 63	Charter Oak
July 64	Chemung
15	Clegg
Apr. 64	Cleveland Institute
July 63	Collins
June 64	Columbia
May 63	Columbia Products
May 64	Comaire
17	Cornell-Dubilier
Jan. 64	Coral Cliffs
July 64	Cubex
13	Cushcraft
Jan. 64	Dames
Apr. 64	Dayton Hamvention
Apr. 63	Delta
July 64	Denver Crystals
86	Denson
Apr. 64	Dow Key
77	Dow Radio
43	Drake
Mar. 63	Ebco
Apr. 64	Editors & Engineers
Feb. 63	Ed-U-Cord
Mar. 63	Electro-com
June 63	Electronic Servicecenter
July 64	Electronic Specialists
Oct. 63	Emrad
May 64	Epsilon Records
65	Evans
Feb. 64	E-Z Etch
4	E-Z Way
87	Fair
July 63	Fairbrother
57	Fichter
July 64	Finney
89	F-M
Apr. 64	FM Ham Sales
Aug. 63	Foreign Projects
33	Foreign Subs
July 64	Fulton
July 64	Gain, Inc.
July 64	Galaxy
Feb. 63	Gam
Mar. 64	Gavin Instruments
57	Gem Electronics
June 64	Glass, J. J.
31	Gonset
91	Goodheart
77	Graham Radio
Jan. 64	Groth
Nov. 63	Grove
Aug. 63	Ham Trader
May 64	Hallicrafters
23	Hammarlund
Nov. 63	Harrington
Mar. 63	Harrison, Ivan
87	Hayden
May 64	HCJ
July 64	Heath
77	Heed
93	Hefron
79	Henry
39	Hi-Par
77	Hi-Way
Oct. 63	Holstrom
73	Hornet
Aug. 63	Howard
Nov. 63	Hunter
30	Hy Gain
33	Hy Que
Jan. 64	Identoplate
May 63	Instructograph
3	International Crystal
5	IoAR
Feb. 64	Irving Electronics
33	Jaro
Oct. 63	Jays
89	Jefftronics
Nov. 63	Johnson
July 64	Joseph's
Jan. 63	Kar-Tenna
73	Kit-Kraft
Nov. 63	Kniper
Mar. 64	Knox
Sept. 63	KTV Towers
June 63	Ladd
33	Lafayette, N. H.
57	Lafayette Radio
Apr. 64	Lawrence Eng
Cover II	Linear Systems
Apr. 64	L R Electronics
Apr. 64	Mach
July 64	Madison
July 63	Maps
35	Master Mobile
July 64	McCoy
95	Meshna
May 64	Metro
May 63	Metrodynamics
May 64	Midwest
June 63	Miller
79	Mini-Products
53	Mission
July 64	M & M
Jan. 63	Mor-Gain
July 64	Mosley
Cover IV	National
Apr. 64	Newark
May 63	New Products
29, 47, 61	Newtronics
July 63	North American
Feb. 64	Northwest
Dec. 62	Nortronics
Adg. 63	Ole's
May 63	Out-O-Door
Jan. 64	Ontario
June 63	Palmer
69	Parks
Jan. 64	Pauls Surplus
Mar. 64	Pausan
Apr. 64	P & H
Apr. 64	Petrilak
June 64	Poly-Paks
Mar. 63	Polytronics
June 64	Propagation Products
July 63	QTH MAPS
July 64	Quaker
55	Quement
95	Radio Bookshop
Apr. 64	Radio Ham Shack
Apr. 63	Radio Industries
Nov. 63	Radio Publications
May 64	Rand
May 64	Ready Radials
71, 73	Redline
Sept. 63	Reed
June 63	Rex
69	Reyco
Apr. 63	Ritco
Apr. 64	Roberts
21	Rohn
Nov. 63	Rowe
Dec. 63	R & S
87	RW Electronics
Sept. 63	Sams
37	Saxton
Feb. 63	Schober
65	Scientific Assoc.
Apr. 64	Seatronics
27	Sideband Engineers
Apr. 63	S. J. Electronics
Mar. 64	Skylane
Mar. 64	Slep
69	Space
Feb. 64	Spitz
Nov. 63	Sprague
15	Squire-Sanders
June 63	Star
93	Subscriptions
Apr. 64	Super-Q
May 64	Surplus Spec
17	Swan
June 64	T A B
Feb. 63	Technical Manuals
41	Technical Materiel
77	Technical Syst.
June 64	Telemarine
Feb. 64	Telemethods
69, 75, 83	Telrex
July 64	Tepabco
59	Texas Crystal
Feb. 64	Thermoelectric D.
July 64	Topaz
85	Transistors Ult.
Jan. 64	Trans Pro
Nov. 63	Trice
Nov. 63	Tri-Ex
June 63	Tri-State
July 64	Tucker
Aug. 63	United
Feb. 63	US Crystals
May 64	U. T. C.
Apr. 63	Valley
33, 75, 77	Vanguard
Oct. 63	Verns
July 63	Versatronics
Feb. 63	Vesto
July 64	V & H
July 64	VHF Associates
Jan. 63	Vibroplex
July 64	Viking
Oct. 63	WA6DUW
19	Waters
Sept. 63	Webster
26	Western (Calif.)
85	Western (Neb.)
Jan. 64	Wildcat Press
July 64	Woodruff
Cover III	World Radio Labs
Apr. 62	Zalytron
93	73 Subscriptions
92	73 Products
62	73 Parts Kits
85	6 Up



M-359	25c
UG-175	15c
UG-176	15c
SO-239	35c
PL-259	35c
PL-259D	90c
SO-239SH	40c
UG-260	35c
UG-604	35c
PL-258	75c

88 MH TOROIDS. Two types available. Open and potted. Used for many applications such as power supplies and teletype.

Open style	50c each
Potted style	65c each

350 WATT DUMMY LOAD

We send you 7 non-inductive resistors each 344 ohms. Connect them parallel for 50 ohm load good for 350 watts. Bag of 7 resistors **$1.25**

IBM WIRED MEMORY FRAMES.

Removed from high priced computors. Exlnt condition.

4,000 core	$12.50
8,000 core	15.00
16,384 core	35.00

MEMORY DRUM w/drive motor, 40 read-write heads **$75.00**

SPECIAL ★ SPECIAL ★ 2 AMP SILICON RECTIFIER, 1,000 PIV **$1.00 SPECIAL**

UNBELIEVABLE COMPUTOR GRADE CAPACITOR

65,000 mfd 12 volt	$4.00
35,000 mfd 12 volt	3.50

MESHNA

19 ALLERTON ST., LYNN, MASS.

Radio Bookshop

Radio Bookshop
Peterborough
New Ham Shire

NEW NEW NEW REVISED INDEX TO SURPLUS—W4WKM This is a complete list of every article ever published on the conversion of surplus equipment. Gives a brief rundown on each article. Revised through June 1964. **$1.50**

2—SIMPLIFIED MATH FOR THE HAMSHACK—K8LFI.—This is the simplest and easiest to fathem explanation of Ohm's Law, squares, roots, powers, frequency/meters, logs, slide rules, etc. If our schools ever got wind of this amazing method of undestanding basic math our kids would have a lot less touble. **50c**

9—COILS—K8BYN.—Basic book which covers the theory and practical aspects of the many different types of coils found in ham work. Well illustrated. **50c**

108—RADIO DATA REFERENCE BOOK—Published by RSGB. This contains all of the formulas that you have to hunt around for when you want them, all in one place and indexed. There are such items as feedline charts, coax tables, yagi measurements, pi-net charts, wire tables, conversion factors, logs, thread sizes, reactance charts, filter design charts, etc. **$2.25**

109—AMATEUR RADIO TOWER INSTALLATION INFORMATION—published by Rohn. Nearly 100 pages of info on selecting, buying and setting up towers for amateur radio. While this book is one of the most complete catalogs of Rohn towers ever published, it also has all the instructions you could possibly want on installing your tower. Lots of good color pictures. Well worthwhile. **$1.25**

11—16TH EDITION RADIO HANDBOOK—by Bill Orr W6SAI. This fantastic book is loaded with the most understandable theory course now available in our hobby plus dozens of great construction projects. This is the best ham handbook in print by a wide margin. Easily worth twice the price. **$9.50**

114—RSGB BULLETIN—One year subscription to the most popular amateur radio magazine in England. Top notch. **$6.00**

107—THE AMATEUR RADIO HANDBOOK—Published by RSGB. This is a thorough and complete 540 pages handbook which covers every aspect of amateur radio: tubes, transistors, receivers, transmitters, VHF gear, sideband, FM, antennas, mobile gear, noise, power supplies, and much, much more. You'll find this one suite interesting and informative. **$5.50**

6—SURPLUS TV SCHEMATICS.—You can save a lot of building time in TV if you take advantage of the real bargains in surplus. This book gives the circuit diagrams and info on the popularly available surplus TV gear. **$1.00**

112—COMMUNICATIONS RECEIVERS—Design considerations and a practical design for radio amateurs. Nicely written 32 page book discusses various stages and presents a fine receiver design for home building using regular commercially available parts. **75c**

SPECIAL SPECIAL SPECIAL

Radio Handbook, 15th Edition, written by Bill Orr W6SAI, over 800 pages. Covers every phase of amateur radio from the very basics right up through the construction of just about everything you could want in ham gear. Originally published at $8.50. Superceded by the new 16th edition which is the same except for new construction projects and selling for $9.50 (see number 11). Special, until the last few copies are gone, only **$5.95!**

28—TELEVISION INTERFERENCE—Rand (W1DBM). This is the authoritative book on the subject of getting TVI out of your rigs and the neighbors sets. **$1.75**

Propagation Chart

EASTERN UNITED STATES TO:

GMT -	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14	14	7	7	7	7	7	7	7	7*	14	14
ARGENTINA	14	14	7	7	7	7	14	14	14	14	21	21
AUSTRALIA	14	14	14	7	7	7	7	7	7	7	14	14
CANAL ZONE	14	14	7	7	7	7	7	14	14	14	14	14*
ENGLAND	7	7	7	7	7	7*	14	14	14	14	14	14
HAWAII	14	14	14	7	7	7	7	7	14	14	14	14
INDIA	7	7	7	7	7	7	14	14	14	14	14	7*
JAPAN	14	14	7	7	7	7	7	7	7	7	7*	14
MEXICO	14	14	7	7	7	7	7	14	14	14	14	14
PHILIPPINES	14	14	7	7	7	7	7	7	7	7*	7	14
PUERTO RICO	14	7	7	7	7	7	14	14	14	14	14	14
SOUTH AFRICA	7	7	7	7	7	14	14	14	14	14	14	7*
U. S. S. R.	7	7	7	7	7	7	7*	14	14	14	14	7
WEST COAST	14	14	7*	7	7	7	7	14	14	14	14	14

CENTRAL UNITED STATES TO:

ALASKA	14	14	14	7	7	7	7	7	7	7*	14	14
ARGENTINA	14*	14	14	7	7	7	14	14	14	14	14*	21
AUSTRALIA	14*	14	14	7*	7	7	7	7	7	7	14	14
CANAL ZONE	21	14	7*	7	7	7	14	14	14	14	14	21
ENGLAND	7	7	7	7	7	7	7*	14	14	14	14	14
HAWAII	14	14	14	14	7	7	7	7	14	14	14	14
INDIA	14	14	7	7	7	7	7	7	7	7*	14	14
JAPAN	14	14	14	7	7	7	7	7	7	7	14	14
MEXICO	14	14	7	7	7	7	7	14	14	14	14	14
PHILIPPINES	14	14	7*	7	7	7	7	7	7	7	7*	14
PUERTO RICO	14	14	7	7	7	7	7	14	14	14	14	14
SOUTH AFRICA	7	7	7	7	7	7	14	14	14	14	14	7*
U. S. S. R.	7	7	7	7	7	7	7	7	7*	14	14	7

WESTERN UNITED STATES TO:

ALASKA	14	14	14	7	7	7	7	7	7	7	7*	7*
ARGENTINA	14*	14	14	7	7	7	7	14	14	14	14	21
AUSTRALIA	14*	21	14	14	14	7	7	7	7	7	14	14
CANAL ZONE	14*	14	14	7	7	7	7	14	14	14	14	14*
ENGLAND	7	7	7	7	7	7	7	7	7	7*	14	14
HAWAII	14	14*	14	14	7	7	7	7	14	14	14	14
INDIA	14	14	14	7	7	7	7	7	7	7	7*	14
JAPAN	14	14	14	14	7	7	7	7	7	7	14	14
MEXICO	14	14	7*	7	7	7	7	7*	14	14	14	14
PHILIPPINES	14	14	14	14	7	7	7*	7	7	7	7	14
PUERTO RICO	14	14	7	7	7	7	7	14	14	14	14	14
SOUTH AFRICA	7	7	7	7	7	7	7	7*	14	14	14	7*
U. S. S. R.	7	7	7	7	7	7	7	7	7	7*	7*	7
EAST COAST	14	14	7*	7	7	7	7	14	14	14	14	14

* Means next higher frequency may be useful.

Good: 10-13, 15-20, 24-26

Fair: 7-9, 14, 21, 23, 28-31

Poor: 2-6, 22, 27

Es: 14-16, 25-26

(High MUF and/or freak conditions)

J. H. Nelson

COMPARE

WRL OFFERS YOU THE FINEST HAM EQUIPMENT ON THE MARKET AT PRICES YOU CAN AFFORD!!

TOP TRADE-IN ALLOWANCE ON YOUR PRESENT GEAR FOR NEW OR USED EQUIPMENT

OVER 1200 PIECES OF RECONDITIONED UNITS AT BEST PRICES AND 4-WAY GUARANTEE

SEND FOR **FREE** "BLUE BOOK" LISTING ON RECONDITIONED EQUIPMENT

SEE WRL FOR ALL YOUR AMATEUR NEEDS

FREE NEW 1964 WRL HAM CATALOG

WORLD RADIO LABORATORIES
3415 WEST BROADWAY
COUNCIL BLUFFS, IOWA 51504

NOW! ORDER YOUR GALAXY TRANSCEIVERS FROM WRL!

GALAXY III

80-40-20 METERS

ONLY...$349.95

NO DOWN PAYMENT . . . . . ONLY $17.00 MONTHLY ON WRL CHARG-A-PLAN

GALAXY V

80-40-20-15-10 METERS

ONLY...$469.95

NO DOWN PAYMENT . . . . . ONLY $21.00 MONTHLY ON WRL CHARG-A-PLAN

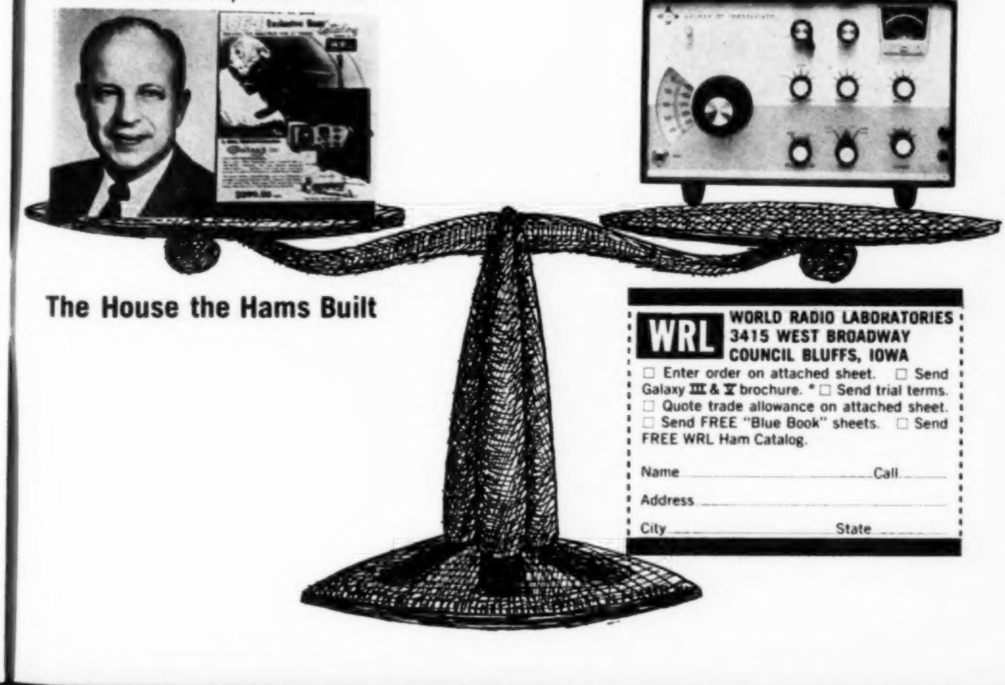
GALAXY OF FEATURES (III & V)

BOTH MODELS – THE BEST IN MOBILE & FIXED STATION OPERATION.

Handsome styling – functional design. Brushed aluminum panel with 4-color etchings. Flat black knobs and perforated steel cabinet with hinged top.

- 300 WATTS SSB/CW INPUT conservatively rated
- FULL COVERAGE ALL BANDS
- BEST FILTER AVAILABLE exceptional 2.1 KC filter stays 60 db down – with 1.8:1 shape factor
- MOST COMPACT 300-WATT TRANSCEIVERS – size, 6" x 10¼" x 11¼". Weighs only 13 lbs.
- SELECTABLE USB OR LSB with illuminated indicators
- ALC CIRCUIT BOOSTS TALK POWER

TWO-WEEK FREE TRIAL*



The House the Hams Built

WRL **WORLD RADIO LABORATORIES**
3415 WEST BROADWAY
COUNCIL BLUFFS, IOWA

☐ Enter order on attached sheet. ☐ Send Galaxy III & V brochure. * ☐ Send trial terms. ☐ Quote trade allowance on attached sheet. ☐ Send FREE "Blue Book" sheets. ☐ Send FREE WRL Ham Catalog.

Name ____________________ Call ________

Address ______________________________

City ____________________ State ________

rockcrusher

National's new 2000 watt linear amplifier is desk-top dynamite. Every component in the NCL-2000 is rated for operation at a "DC" kilowatt. If you want to check power output you'll need a bigger wattmeter than those now available on the amateur market. On any band the '2000 will pin a meter that only reads 1000 watts full scale.

Addition of the NCL-2000 to your desk-top station allows you to run at the maximum power allowed by law. It's no half-way linear with TV components and a "Christmas tree" string of receiving tubes straining to deliver a doubtfully efficient 500 watts (average) input. The two 8122 ceramic tetrode output tubes were designed specifically for SSB, and provide 800 watts of plate dissipation to assure conservative operation — and at a replacement cost of only $31.50 each.

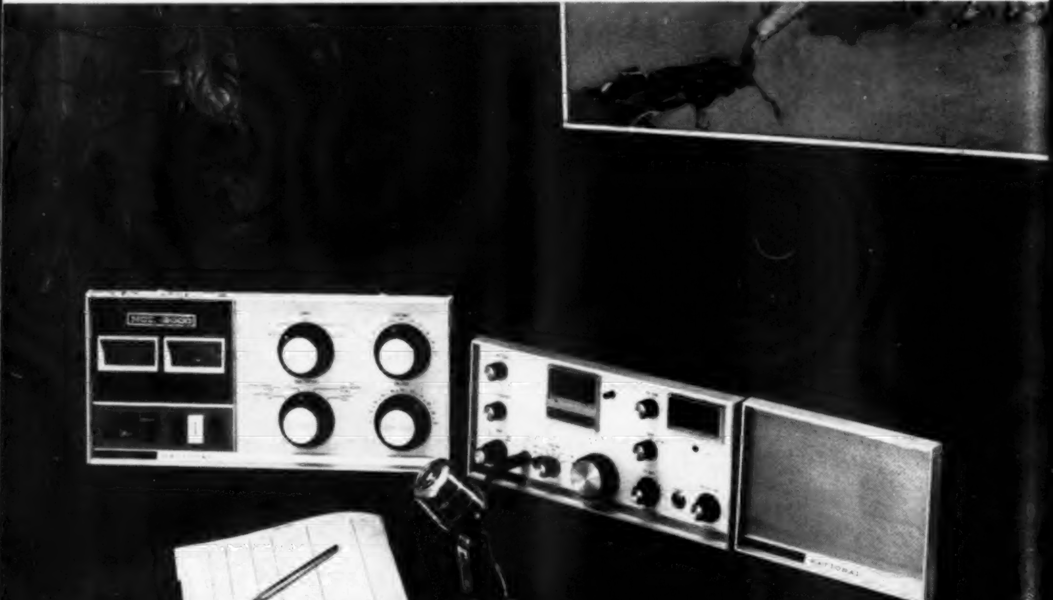
Not only does the NCL-2000 deliver the power, but it does it cleanly. Third and fifth order distortion products are down 30 to 45 db, hum and noise down a minimum of 40 db. Operate in areas of high humidity? Don't worry about power supply or plate circuit breakdown. The '2000 is rated for full output at 90% ambient humidity. Properly safety conscious? You would have to work to get by the lid interlock that positively breaks all power to the plate relay, or the automatic shorting bar that discharges B + directly to ground (throwing out the overload relay) in case of the remot possibility of interlock or bleeder failure. In addition, the equipment itself is protected through a one minute time delay rela and a plate overload relay.

Very simply, no other amplifier on the market at any pric gives you even half of these features: ■ 2000 watt PEP input o SSB, 1000 watt input on CW, RTTY, or AM ■ Equal power outpu on all bands 80 through 10 meters ■ Completely self-containe desk-top package with built-in power supply ■ Exclusive grid-controlled AB_2 operation for high efficiency and linearity ■ Ma be driven to full output with any exciter delivering 20 watts t 200 watts PEP ■ Passive grid with internal 50 ohm exciter dumm load and relative exciter output indication for simplest tuneu ■ All necessary relays built in for transceiver or transmitter-receiver operation ■ Instantaneous switchover to exciter-onl operation when desired ■ ALC output ■ Separate precisio plate and multimeters ■ Most complete safety and overload protection, including 1 minute time delay relay, overload relay, lid interlock and automatic shorting bar ■ National's exclusive One-Year Guarantee.

Your National dealer has the NCL-2000 in stock right now . . . at only $585, better buy one in self defense.

NATIONAL RADIO COMPANY, INC.
37 Washington Street, Melrose, Mass. 02176

World Wide Export Sales: Ad Auriema Inc., 85 Broad St., N.Y.C.; Canada: Tri-Tel Associates, 81 Sheppard Ave. W., Willowdale, Ontario

This handsome desk-top station includes the NCL-2000 Amplifier ($585), the NCX-3 Triband Transceiver ($369) and the NCX-A AC Power Supply ($110). The NCX-D DC Power Supply is available for the NCX-3 at $119.95.